MAY 17, 1954

Electrical World

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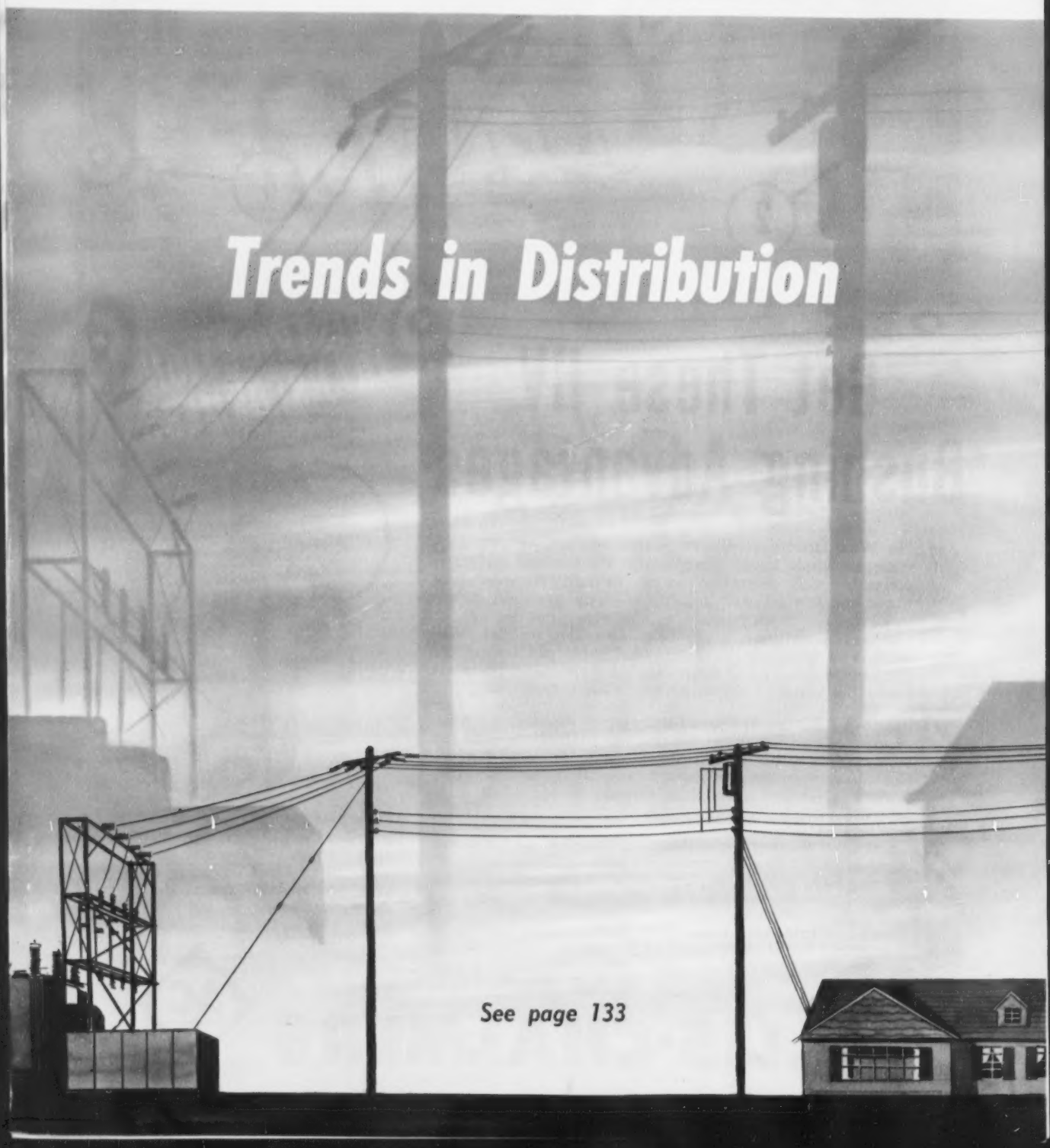

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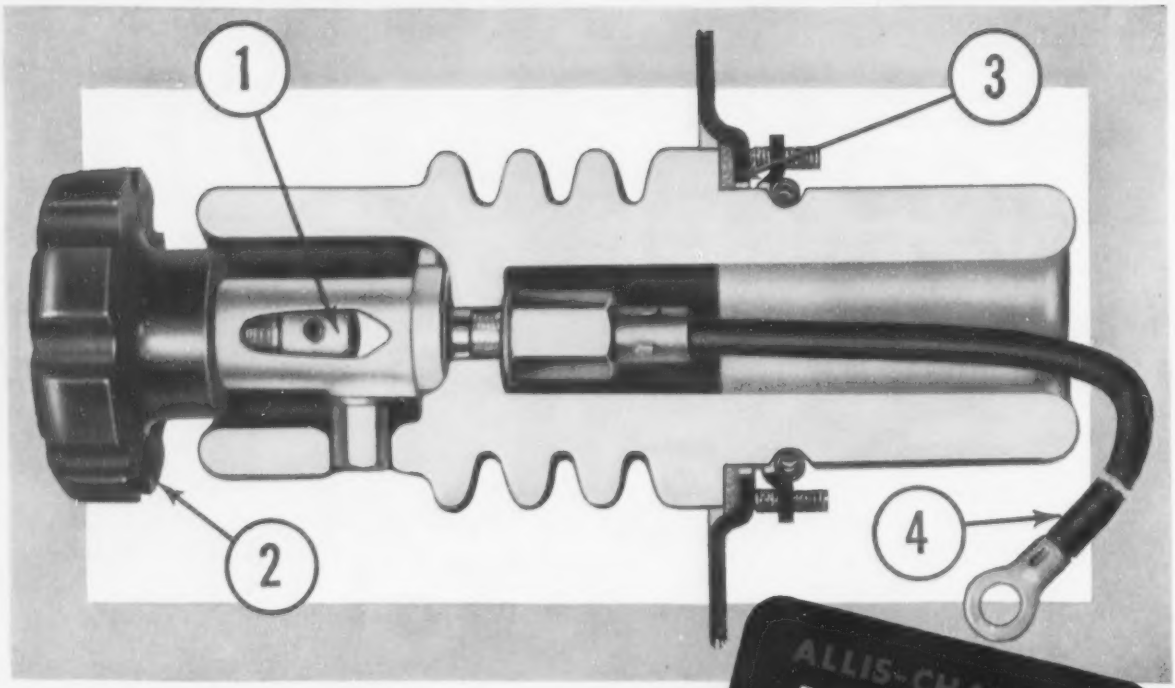

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3 Controlled Gasket Pressure! Recessed seat in tank wall controls gasket flow for most effective seal. Internal clamping ring locks bushing in place and at the same time evenly compresses corprene gasket for effective seal.

4 Simplified Internal Connection! Bushing cable terminates at terminal board. Easy removal simplifies routine maintenance.

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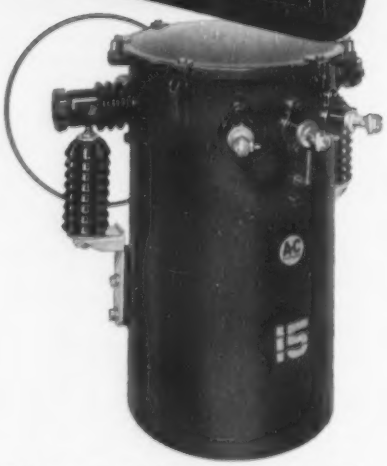

This new straight sidewall bushing is supplied on Allis-Chalmers distribution transformers 167 kva and smaller, 5 kv and below. Get complete facts from your nearby Allis-Chalmers distributor or district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Meet This Week's Authors

W. J. LYMAN V. E. HILL

Contributions of service reliability standards to planning and operation are highlighted in an article on page 150. Authors of the article are two Duquesne Light Co veterans: Walter J. Lyman, vice president, and V. E. Hill, system development engineer.

Lyman's career with the Pittsburgh utility began in 1924 when he started as an apprentice engineer. Since then he has served as a junior engineer, assistant field engineer, engineering department; and as section engineer and manager, planning and development department, a post he filled prior to becoming a vice president.

Electrical Engineer . . . Hill was employed by the Company in 1927, as an apprentice engineer. Prior to becoming system development engineer, he served in various engineering posts. Hill graduated from Worcester Polytechnic Institute in 1927 with a BS degree in electrical engineering.

M. N. Bennett, assistant electrical engineer of Modesto (Calif.) Irrigation District, explains on page 152 how a 4-wire bank saves money when residences have 3-phase loads. Bennett joined the Modesto utility in 1941, working in the field of power distribution.

M. N. BENNETT

Golf Enthusiast . . . When he isn't hitting an "Ike" par on the golf course, Bennett is puttering around with the hammer and saw making outdoor patio furniture.

Electrical World

Published for 80 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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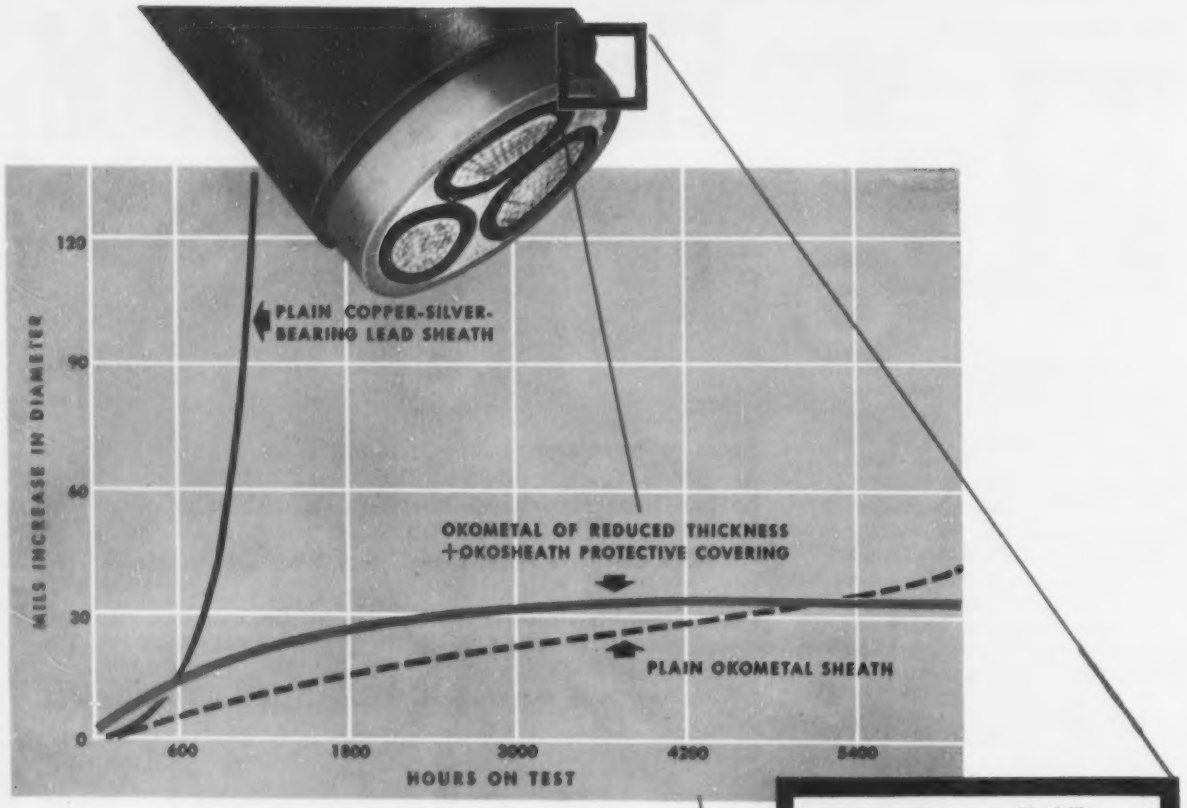

Wax & Mica Lubricated Finish
Double-wrap OKOPRENE impregnated fabric tape
Impervious wall of OKOPRENE
OKOPRENE impregnated fabric tape bonded to lead
LEAD SHEATH
SECTION OF COMPOSITE SHEATH

This plot has a story for paper cable users

The curves plotted above tell the story of high internal pressure tests made on three lengths of paper cable indentical in construction except for the sheath design.

Cable Sheath #1: Copper-silver-bearing lead of AEIC recommended thickness

Cable Sheath #2: Okometal alloy of AEIC recommended thickness

Cable Sheath #3: Composite design with Okometal alloy of two-thirds AEIC thickness plus Okosheath Protective Covering

Sheath #1, having the least resistance to internal pressure, started to "neck down" or thin-out at one spot, which led to a rapidly increasing expansion and failure after only 1152 hours on test. Sheath #2, made with unprotected Okometal of full AEIC thickness, was still on test after 6000 hours, indicating its superiority over a conventional lead sheath. Composite sheath #3, made with Okometal of reduced thickness but having an Okosheath Protective Covering, was not only still on test after 6000 hours, but also showed a flat curve that indicated the highest degree of stability with no tendency to "neck down."

Along with the advantages disclosed above, the composite sheath construction of Okometal plus Okosheath Protective Covering possesses superior resistance to scoring during installation and eliminates both chemical and electrolytic corrosion. These features are fully discussed in Bulletin EW-1047, available upon request from The Okonite-Callender Cable Company, Passaic, New Jersey.

OKONITE insulated cables

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Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

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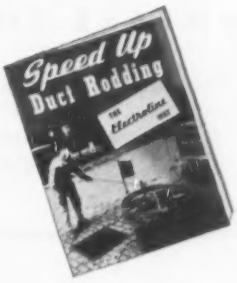
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.



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New circuit interruption technique in S&C's TYPE XS CUTOUT increases interrupting capacity, but not the cost.

Designed to meet the higher fault currents of today's distribution systems, the S&C Type XS is a standard-duty cutout with respect to distribution economics, but a heavy-duty cutout in its interrupting capacity. It has interrupting ratings which conform to those established by NEMA for certain heavy-duty cutouts—hence the XS may be applied wherever you need an open cutout.

An ingenious "recoil mechanism" is the heart of the Type XS Cutout. It presents a new approach to the problem of handling the energy associated with circuit interruption.

It makes heavy-duty performance possible without resorting to the methods used conventionally for increasing cutout capacities—heavier construction, larger bore, and double venting — methods which not only increase costs but usually sacrifice low fault current protection.

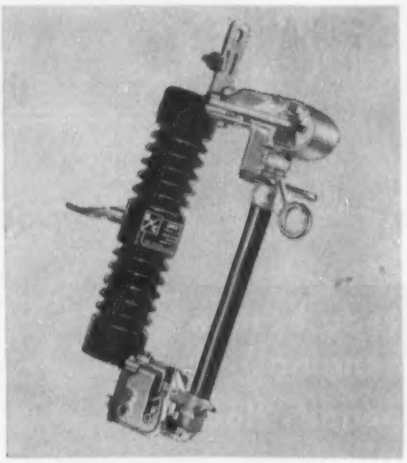
COMPARE THE CAPACITIES

The XS has an interrupting rating of 5,000 amperes (7.5 kv) and 4,000 amperes (15 kv) as compared to other standard-duty cutouts which are rated 2,000 amperes (7.5 and 15 kv).

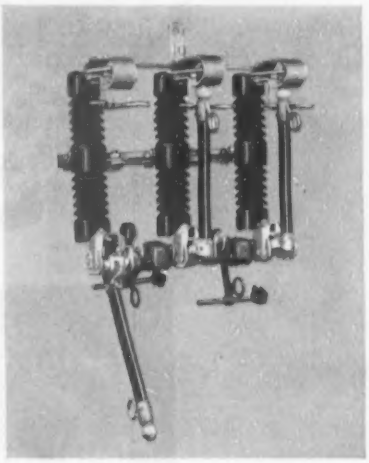
MODERN IN CONCEPT

MODERN IN DESIGN

MODERN IN APPLICATION



S&C TYPE XS CUTOUT
single-shot, birdproof



S&C TYPE XS CUTOUT
three-shot, birdproof

THE TYPE XS CUTOUT

offers added advantages by eliminating:

√ the time-consuming operation of short-circuit zoning analysis to determine whether a standard-duty or a heavy-duty cutout is needed in each particular location.

√ ordering or stocking two types.

√ carrying two types of cutouts in service trucks.

√ the worry about construction crews installing the wrong cutout or tube at protection points.

Complete information on the Type XS Cutout is contained in new Catalog Section 511 . . . we will gladly send you a copy.

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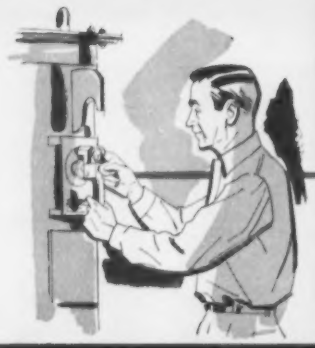
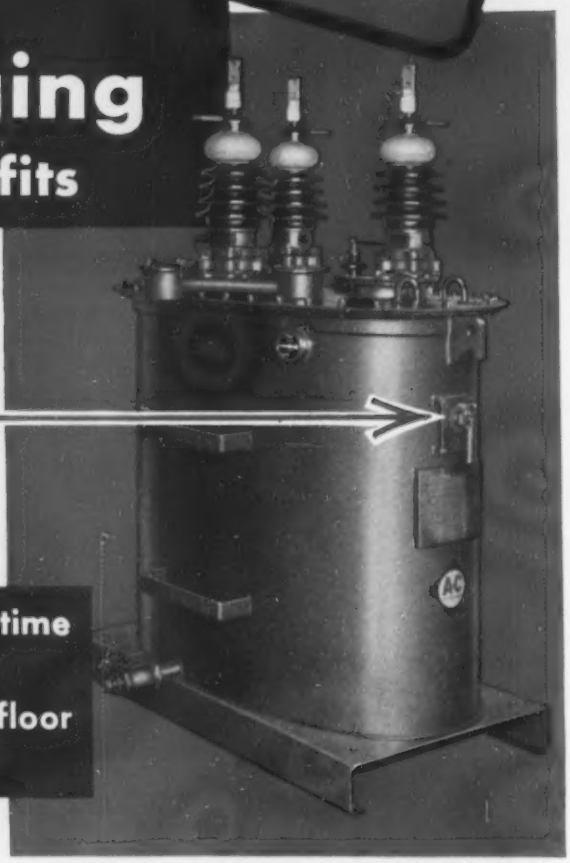
ALLIS-CHALMERS Instrument Transformers





- **FASTER** – reduces time for ratio changing
- **SAFER** – permits floor level operation

External ratio changing is now standard on Allis-Chalmers metering outfits for current ratings up through 200/400 amp, 25 kv through 69 kv. Consult factory for ratio changer on 15-kv metering outfits.

NOW Allis-Chalmers gives you *external* ratio changing on metering outfits. A real convenience — just de-energize the circuit and rotate the handle. All phases are changed simultaneously. The ratio changer used is the same rugged "point contact" mechanism already proved in service on Allis-Chalmers power transformers.

Ratio Changer Features

Contacts are self-aligning. Contact pressure is equal and positive; it is increased as a result of magnetic forces. A single current path is established by round point contact under high unit pressure against a flat stationary contact. Strong wiping action cleans surfaces for good contact.

Get Complete Information

Find out how Allis-Chalmers metering outfits with *external* ratio changing for de-energized operation give you faster, safer, simpler operation. Call the A-C office nearest you, or write Allis-Chalmers, Milwaukee 1, Wis.

A-4359

You get high safety factor and sound electrical design in Allis-Chalmers metering outfits. Insulation life is extended because corona is minimized — one more step toward longer service life. All metering outfits are furnished with double current ratings to provide for future load growth.

A-C ALLIS-CHALMERS

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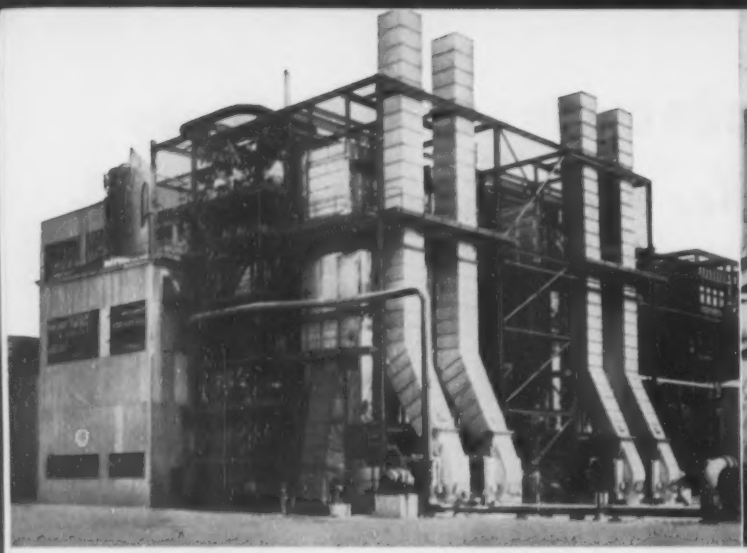
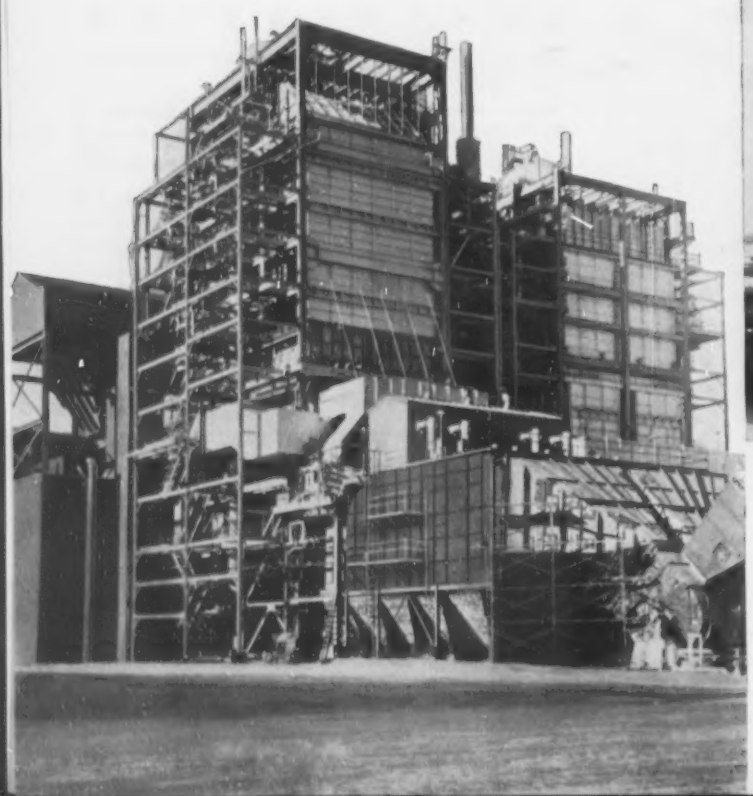


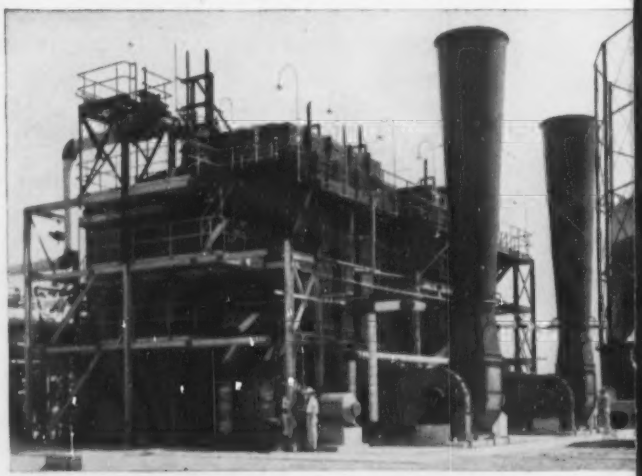
Two of ten 450,000 lbs./hr. outdoor steam generating units that were recently installed by Riley at Dow Chemical Co., Freeport, Texas. Design Pressure 1450, steam temp. 950°F. Fuel—Natural Gas; Efficiency 81.9%. Stone & Webster, Engineering Corp.

Moniteau Plant at Chamois, Mo. of the Central Electric Power Co-op. has most of its Riley boiler outdoors. Capacity 160,000 lbs./hr. Design pressure 975 psig. Temperature 900°F. Kuljian Corporation, Consultants.

Let's Look OUTDOORS at RILEY

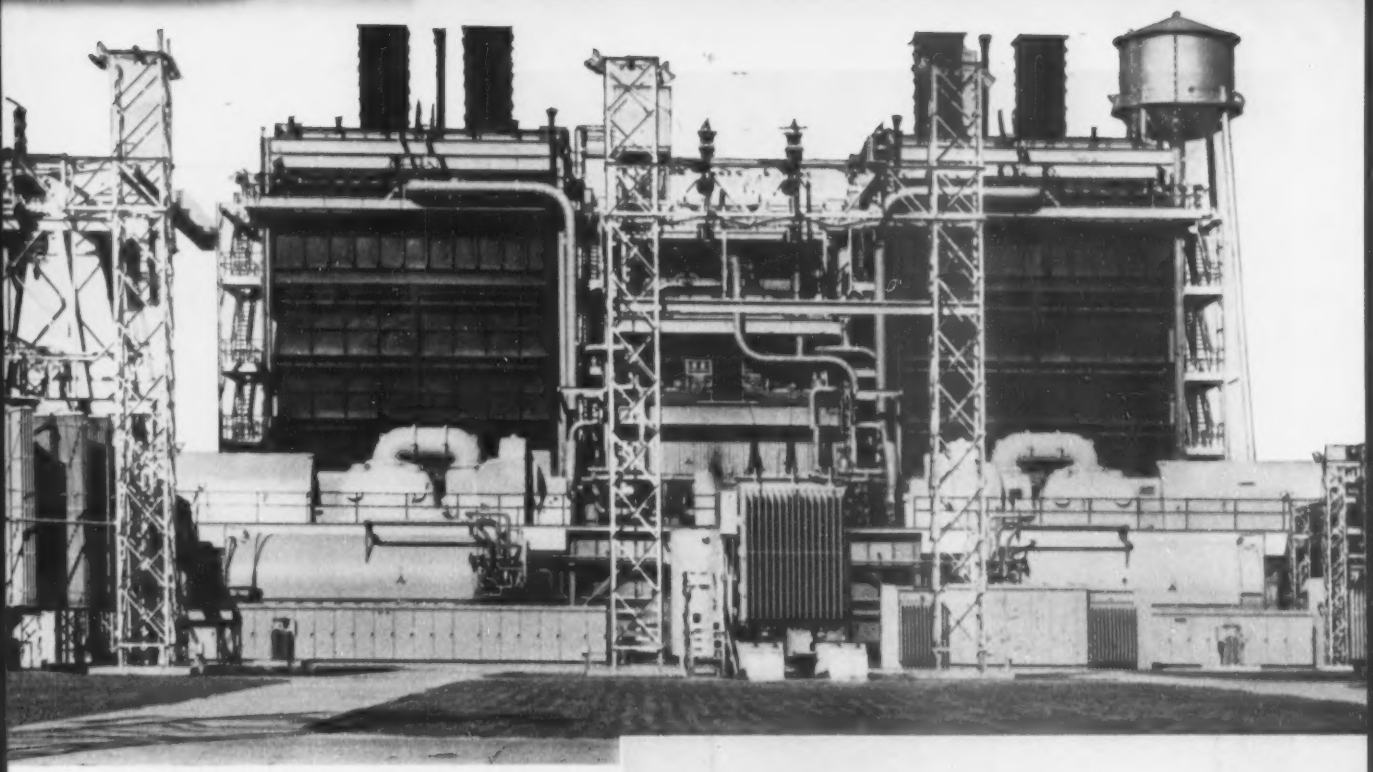
When you are specifying new steam generating equipment it may pay you to consider installing a Riley outdoor or semi-outdoor unit. Many industrial and public utility companies have affected considerable savings by installing Riley units either completely outdoors or just partially enclosed. Your Riley sales engineer or Consulting Engineer will advise you whether an outdoor or a semi-outdoor Riley steam generating unit is practical for your requirements.



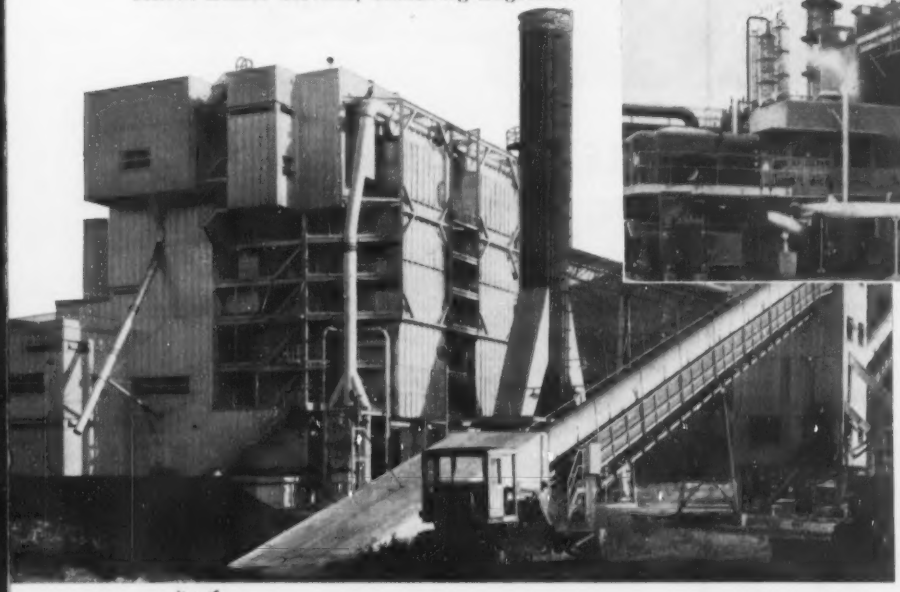


Two completely outdoor Riley steam generating units are part of recent expansion program of Commercial Solvents Corporation at Sterlington, Louisiana. Capacity 125,000 lbs./hr. 675 lb. design pressure, 735° Fahrenheit. Ford, Bacon & Davis, Consultants.

Utah Power & Light Company's new Gadsby Plant has two Riley outdoor type high pressure steam generating units. Unit #1 620,000 lbs./hr. 1510 psig, 950F. Unit #2 575,000 lbs./hr., 1525 psig, 1005F. high pressure and reheat steam temperature. Bechtel Corporation, Consulting Engineers.



Two completely outdoor Riley steam generating units each with 675,000 lbs./hr. capacity at Houston Lighting & Power Company's Green's Bayou Station are two of eleven Riley units purchased by this public utility. One Riley 1,200,000 lbs./hr. outdoor reheat unit is now under construction and another will soon follow. Ebasco Services, Consulting Engineers.



One of two all-outdoor 200,000 lbs./hr. Riley boilers with pressurized furnaces installed by Riley for a large Chemical Co. Steam pressure 900 psig, temperature 875°F. Fired by natural gas. Ebasco Services, Engineers.

Prominent are the air preheater casings of two 210,000 lbs./hr. Riley boilers of West Penn Power Company's Milesburg, Pa. Station. Operating steam pressure 850, Temperature 900F. Sanderson and Porter, Engineers.

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A SINGLE RUN OF COPE CABLE TROUGH CAN DO A MAN-SIZED JOB

The above photograph, taken in a section of the new Scott Paper Co. plant at Everett, Washington shows one run of Cope Cable Trough carrying four sets of three phase triplexed cable carrying 2300 volts properly spaced to give a free-air rating.

Because of its low cost and ease of installation, Cope Cable Trough is extremely popular as a standardized system for supporting power and control circuits in the industrial and utility field.

Cope Cable Trough is available in straight runs and a wide range of fittings (tees, elbows, drop-outs, etc.) which enables the entire system to be quickly and easily erected at the job site to conform to any layout.

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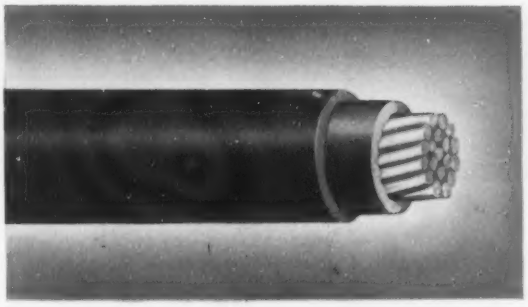

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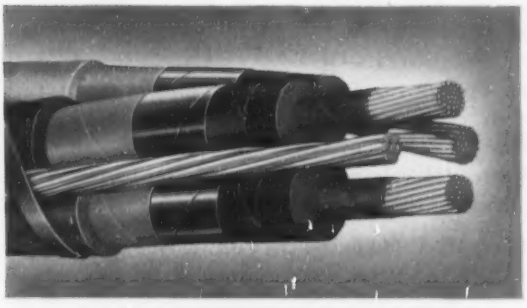

U. S. Grizzly Power Cable, 15,000 volts – Type RR – 3-conductor, Uskorona® – ozone-resistant insulation – shielded – Neoprene jacket.

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2. Greater flexibility
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4. Easier to splice, tap and terminate
5. More resistant to chemical corrosion
6. Unaffected by stray currents
7. Better protection against weathering
8. Longer life
9. Cost less
10. Made by United States Rubber Company, the *only* electrical wire and cable producer to grow its own natural rubber, make its own synthetic rubber and manufacture its own plastics

U. S. Grizzly Power Cables are used for general power distribution, and can be installed in conduits, underground ducts, buried directly in the ground, or installed aerially. Neoprene jacket protects against acids, alkalies, oils, and mechanical damage and weathering. (All IPCEA and NEMA specifications complied with.)

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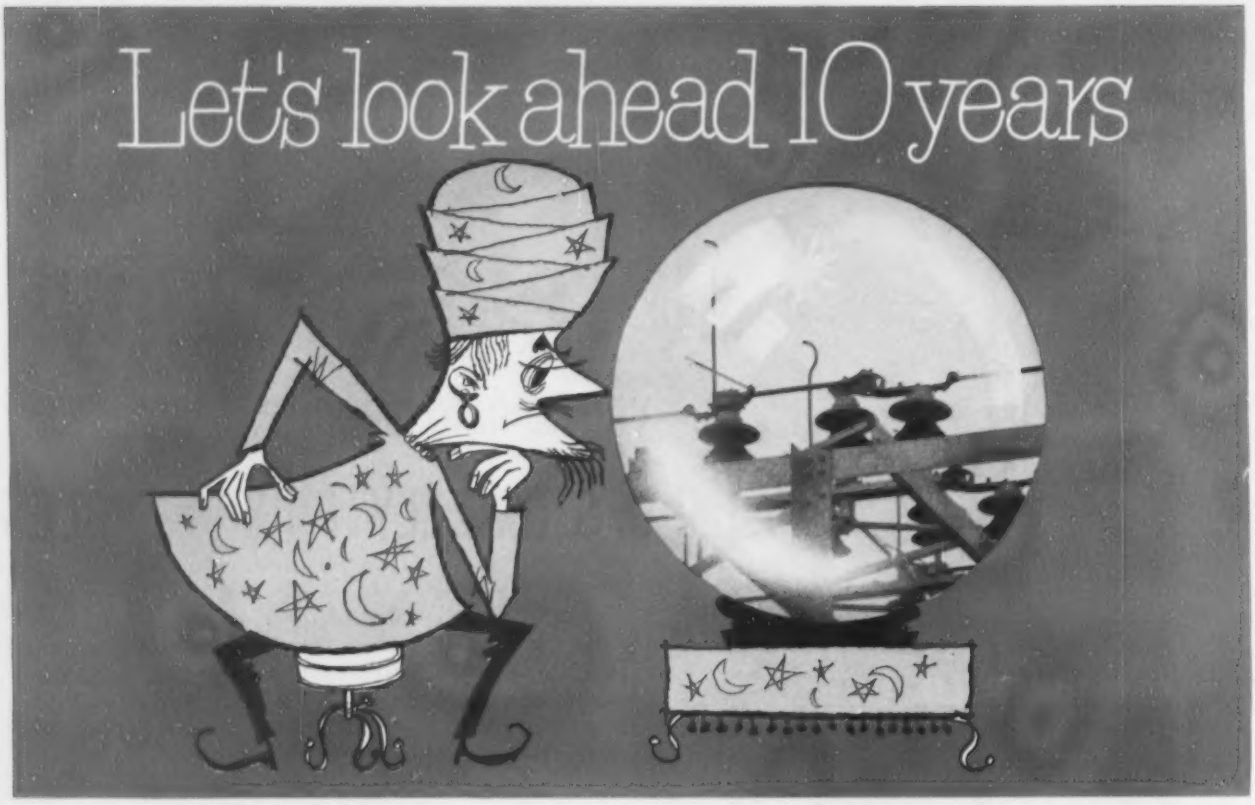
ELECTRICAL WIRE AND CABLE DEPARTMENT, ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Let's look ahead 10 years



Will the Hi-Voltage Switches that you install in 1954 withstand the short-circuit currents of 1964? The answer is definitely "yes". We cannot anticipate a short-circuit current great enough to "UNLOCK" a Hi-Voltage Switch.

WHY? There are two main reasons

1—Note in Figure 1 on the opposite page how short Dimension A is. If the leads to and from the switch were exactly in line with the switch blade, there would be no tendency for the blade to open under short circuit currents. However, for mechanical reasons, there must be a Dimension A, and if this dimension is increased, the force tending to open the switch increases. *Therefore, Hi-Voltage keeps Dimension A as small as possible.* This is of particular importance when you consider that as the magnitude of a short-circuit current grows, its opening force increases as the square of the current. Doubling the current will produce four times the force, and so on.

2—The second main reason why a short-circuit current cannot "unlock" a Hi-Voltage Switch is the exclusive "IN-OUT-UP" action illustrated on the opposite page. Because of this action, the blade moves laterally into the sleet hood. The contacts are *positively* locked at the tip end. Of course, Hi-Voltage also employs the customary method of blocking the linkage at the hinge end.

When Hi-Voltage Switches are closed, they stay "locked" until *you* want to open them.

HI-VOLTAGE

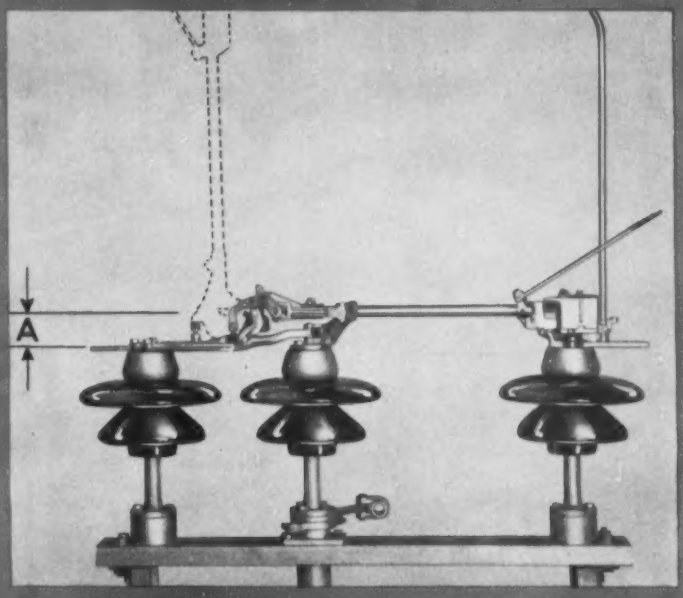


Figure 1—Dimension A is made as small as possible to minimize the hammering and heaving of short-circuit currents on contacts, blades and terminals.

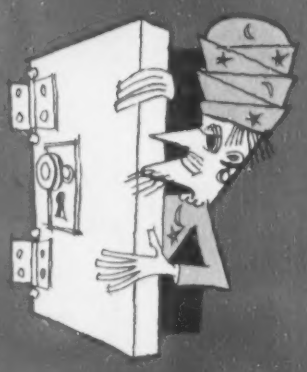


Figure 2—Locking by blocking only the linkage of a switch seems somewhat like putting a lock on the hinge side of a door.

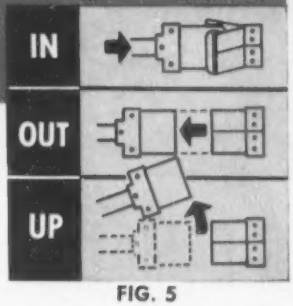


FIG. 5

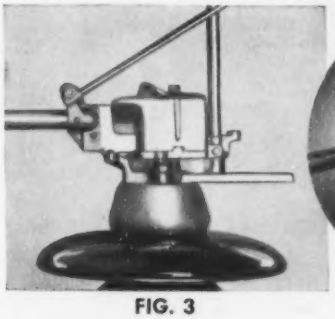


FIG. 3

FIG. 4

OPERATING PRINCIPLE OF EXCLUSIVE "IN-OUT-UP" ACTION

(FIGURES 3, 4, 5)

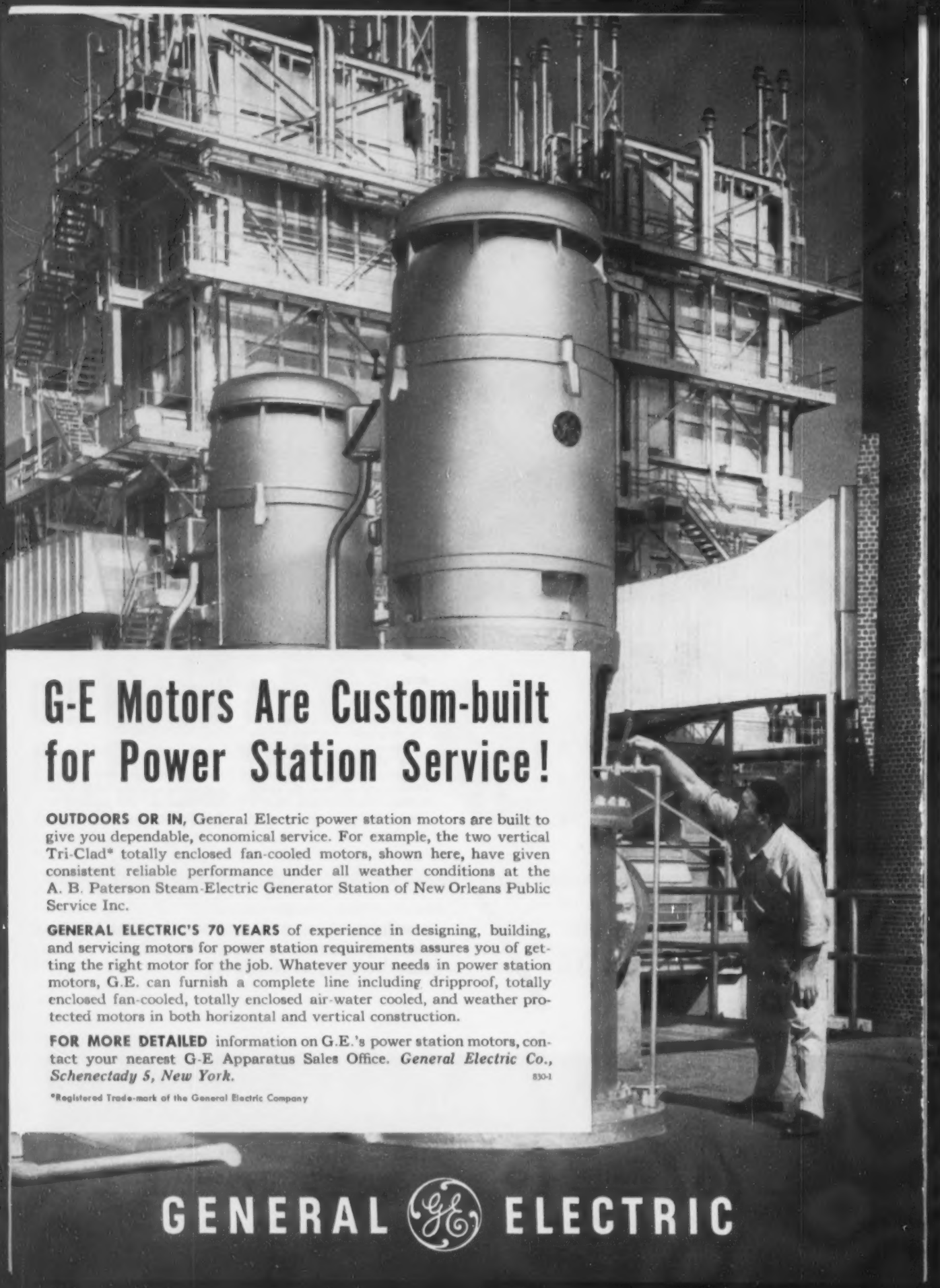
When closing, switch blade *pushes* directly and horizontally into the silver-inlay contacts. When opening, switch blade *pulls* directly and horizontally from the silver-inlay contacts. Then, the switch blade is automatically lifted to the vertical position by the powerful operating mechanism. *There is no twisting or turning.* In Fig. 4, the steel hood has been removed to show the contacts.

The EXCLUSIVE "IN-OUT-UP" action is just one of the many outstanding features of Hi-Voltage Switches. Ask your Joslyn Representative about:

SILVER positive-pressure contacts.
MONEL BALL BEARINGS that never require any lubrication.
DIRECT MECHANICAL operating mechanism.
LOWEST POSSIBLE installation costs.

HI-VOLTAGE EQUIPMENT COMPANY

4000 EAST 116TH STREET • CLEVELAND 5, OHIO



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OUTDOORS OR IN, General Electric power station motors are built to give you dependable, economical service. For example, the two vertical Tri-Clad* totally enclosed fan-cooled motors, shown here, have given consistent reliable performance under all weather conditions at the A. B. Paterson Steam-Electric Generator Station of New Orleans Public Service Inc.

GENERAL ELECTRIC'S 70 YEARS of experience in designing, building, and servicing motors for power station requirements assures you of getting the right motor for the job. Whatever your needs in power station motors, G.E. can furnish a complete line including dripproof, totally enclosed fan-cooled, totally enclosed air-water cooled, and weather protected motors in both horizontal and vertical construction.

FOR MORE DETAILED information on G.E.'s power station motors, contact your nearest G-E Apparatus Sales Office. *General Electric Co., Schenectady 5, New York.* 830-1

*Registered Trade-mark of the General Electric Company

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POWERS American

Series 450 CONSTRUCTION AND OVERHEAD MAINTENANCE BODY

Does the Work of TWO TRUCKS

Ladder can be revolved 360° at elevations from 30° to 75°. In 23'6", 26'6", and 30'6" mechanical units, or 35' hydraulic model.

Body is 108" long, for installation on dual-rear wheel chassis having cab-to-axle dimension of approximately 60"

Here's a multi-purpose body that does work normally requiring two or more specially-equipped vehicles.

FOR OVERHEAD WORK . . . the body has a Powers-American mechanical or hydraulic Aerial Ladder, in a working height best suited to individual needs.

FOR SERVICE WORK . . . compartments provide space for the orderly storage of a wide assortment of tools and parts.

FOR CONSTRUCTION WORK . . . simplified, easy-to-use derrick handles poles up to 35 ft. in length. A 10,000 lb. underslung winch pays out cable beneath the body floor. A universal swivel sheave permits winch line pull in any direction, without limitation.

COMPLETE DESCRIPTION is given in Bulletin No. 118. A copy, with quotation, is yours for the asking.

Derrick utilizes flexible steel cable instead of conventional center leg. Stows in loading area rack when not in use.

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McCABE-POWERS AUTO BODY COMPANY
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CONGRATULATIONS

to the winners of the

George A. Hughes

awards for

1953

Hotpoint is happy to join with the rest of the Electric Industry in congratulating these electric utility companies for their accomplishments during 1953.

They led America's utility companies in the successful promotion of the use of major electrical appliances. By so doing, they brought greater comfort and convenience to their customers—through modern electrical living.

Hotpoint is proud to give recognition to these progressive utility companies and their employees—the winners of the George A. Hughes Awards for 1953:

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Electric Range Activity
Cleveland Electric Illuminating Co., Cleveland, Ohio

Commercial Electric Cooking Activity
The Ohio Edison Co., Akron, Ohio

DIVISION B *(Under 250,000 Meters)*

Electric Range Activity
Kentucky & West Virginia Power Co., Inc., Ashland, Kentucky

Electric Water Heater Activity
Florida Power Corp., St. Petersburg, Florida

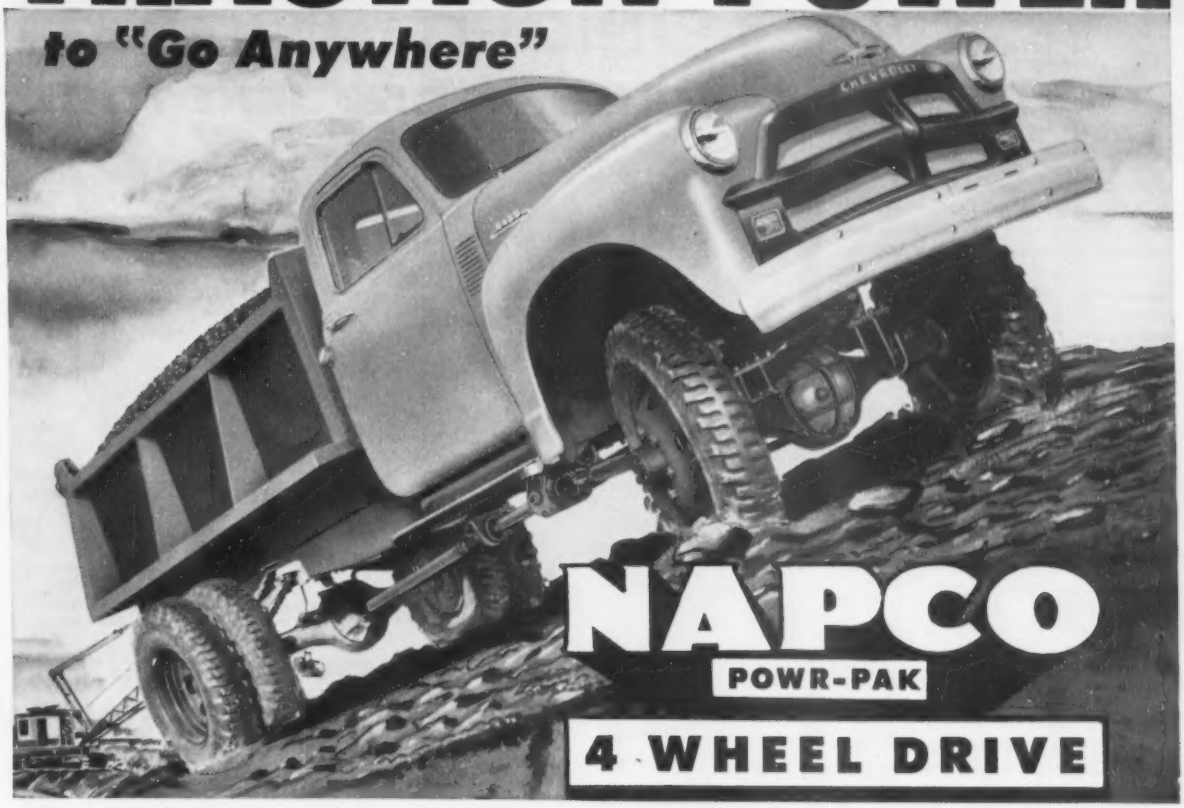
Commercial Electric Cooking Activity
Atlantic City Electric Co., Atlantic City, New Jersey

Hotpoint

PLAN NOW TO ENTER THE **1954** COMPETITIONS. WATCH FOR DETAILS—TO BE ANNOUNCED SOON...

TRACTION POWER

to "Go Anywhere"



***Completely Proven**

A *new improved model* of the same military-type 4 wheel drive chosen by the U. S. Armed Forces for the hundreds of thousands of Chevrolet trucks used throughout the world during World War II.

Utilizes Standard Replacement Parts

Because all replacement parts for the entire differential of the front axle assembly are available at any Chevrolet dealer, many of the maintenance problems formerly associated with 4-wheel drive units for Chevrolet trucks have been solved.

Standardizes Your Fleet

Chevrolet trucks equipped with the NAPCO 4 wheel drive remain unchanged except for the addition of the Powr-Pak itself. No special maintenance stock of parts is needed.

See our specifications in the **CCJ** Truck Specifications Section—April issue.

WITH 2 SPEED RANGE FOR

CHEVROLET TRUCKS

UTILIZING STANDARD REPLACEMENT PARTS

Now, for the first time, you can buy a Chevrolet truck, world's best truck value, equipped with NAPCO Powr-Pak, world's most proven* 4-wheel drive. Your local Chevrolet dealer can order your new Chevrolet truck equipped with the NAPCO Powr-Pak, or can convert trucks of your present fleet.

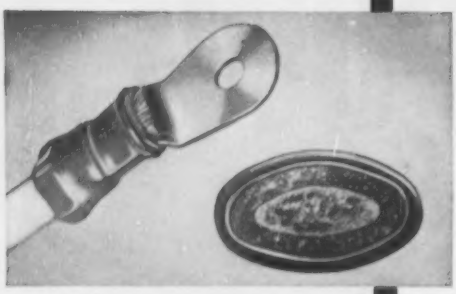
NAPCO's Powr-Pak gives your Chevrolet trucks the extra traction power to "go anywhere" . . . over rough terrain, through ice and snow, mud and sand! It reduces costly "down time" . . . it enables you to keep bigger payloads rolling whether it's over highways or across tough "off the road" terrain.

What's more, NAPCO Powr-Pak equipped Chevrolet trucks give you all the ease of handling features you've always wanted. At high speed operation over highways there's not a trace of whip or weave . . . no fighting the wheel. And, when the going gets tough "off the road," just a flip of a lever gives you finger tip control of the extra traction power necessary to get bigger payloads through on schedule. The normal easy turning and handling characteristics of Chevrolet trucks are not affected by the NAPCO Powr-Pak installation.

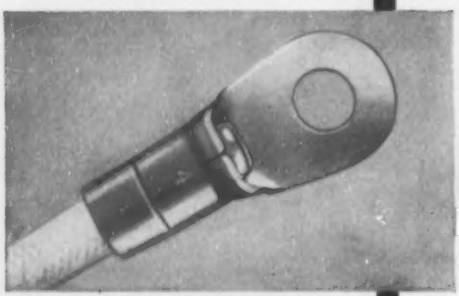
See your Chevrolet dealer, or write for complete information! The low cost of a completely equipped Chevrolet 4-wheel drive truck will surprise you —hundreds of dollars less than any 4-wheel drive in comparable capacity.

NAPCO PRODUCTS DIVISION

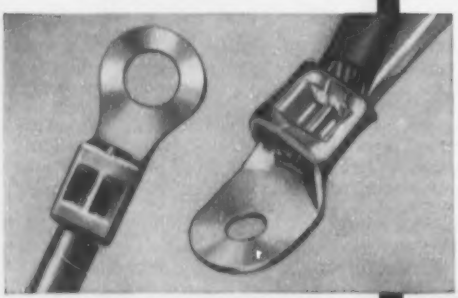
NORTHWESTERN AUTO PARTS CO. **834 N. 7th St., Minneapolis, Minn.**



FOR AMPLI-BOND TERMINALS
A-MP's bonded insulation, Confined "C" Crimp, and insulation support features make precision-engineered AMPLI-BOND terminals the best quality insulated termination for copper wire. Special crimping head applies superior A-MP "C" Crimp for wire sizes 8 through 2.



FOR ALUMINUM CONDUCTOR TERMINATIONS
For applications where weight is the primary consideration, A-MP's novel cartridge type terminals, available in wire sizes 8 through 2, are applied with the same head as that used for AMPLI-BOND. These aluminum wire terminals offer, by way of insulation support, Confined "C" Crimp, and special inhibitor, a completely trouble-free termination.



FOR SOLISTRAND TERMINALS
The AMP W CRIMP for solid wire has two longitudinal indents which compress terminal and wire with a toggle action to produce a voidless, homogeneous mass within the crimp area. There is no finer crimp for solid, irregular shaped or combinations of these wire types.

Find out about the New AMP "CREATIVE APPROACH TO BETTER WIRING"

... An evaluating survey without cost or obligation.

NEW AMP LIGHTWEIGHT HAND HYDRAULIC TOOL

FEATURES:

- 6 TONS FORCE
- SWIVEL ACTION
- SPRING ACTUATED

More than one ton of force per pound of weight makes crimping even No. 2 terminals easier than ever before. Two styles of head are available, one for "W" Crimp, the other for "C" Crimp. The "W" Crimp is for solid and stranded wire and for uninsulated terminations. The "C" Crimp is for insulated terminations on stranded, copper wire and for uninsulated terminations of aluminum wire. Rotating nests or removable inserts give wide wire size range for each head.

It's light! Weighs only 5 lbs. Double lever action of new tool reduces pumping time effort—takes 50% less strokes than conventional hand hydraulic tools. Sudden decrease in pressure indicates to the operator that the crimp is completed.

Literature on tool and terminals available upon request.

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SWITCH BOARDS

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Easier Installation because removable front and back plates expose generous wiring parts. Isolated horizontal wiring trough has drop-off openings, assuring safer, neater wiring.

Flexibility. Complete sections or branch units can be added or changed to meet specific job requirements.

Easier Inspection and Maintenance. Front, side and back plates are removable, thus providing easy and immediate access to specific areas.

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PLUG-IN
CONTROL CENTERS

DESIGN LEADERSHIP FEATURES

Increased Safety because bus bars are fully enclosed, rigidly supported and have ample cross section...circuits isolated by individually enclosed plug-in units...disconnect handle designed for maximum operator protection.

Flexibility. Individual plug-in units or complete sections can easily be added, removed or exchanged. Push-buttons, pilot lights, and selector switches can readily be added to unit doors.

Installation Economy. All wiring channels are large and accessible from front without removing units...no "wire fishing."

Space economy, too. Up to six combination starters fit in a 20"x20"x 90" section. Plug-in unit heights are designed in space-saving increments of 3 inches.

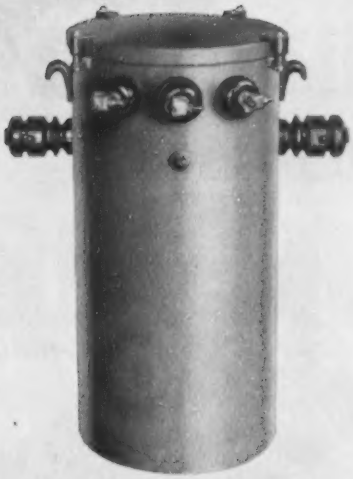
SQUARE D COMPANY

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

● If transformer failure keeps your linemen busy removing distribution transformers and installing new ones, then it's time to investigate Standard Transformers as a solution to your problem. Once a Standard Distribution Transformer is installed on a line, it's there to stay . . . silently channeling current to your customers.

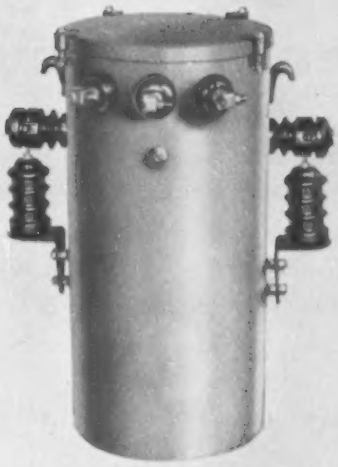
What makes Standard Distribution Transformers such dependable "watch dogs"? Close examination discloses sound, basic construction in full accordance with ASA and REA standards. Outstanding features set them apart from others as an indispensable and integral part of your distribution system. Covers are moisture-proofed with Neoprene gaskets which prevent oil leakage. They can be easily and quickly removed, allowing immediate access to vital parts. A rugged, copper-bearing steel tank houses the low-loss core assembly of non-aging, varnish-coated, silicon steel sheets. Specially designed core clamps hold core rigidly in place assuring quiet, trouble-free operation. These, plus numerous other construction features, demonstrate Standard Transformers to be helpful in solving your excessive maintenance problem.

Naturally, you want more information concerning Standard Distribution Transformers than that which we have presented in these limited words. Your nearby Standard Transformer representative has answers to your questions. Call him. Let him show you how Standard Distribution Transformers can help you maintain the excellent service your customers deserve.



← Type A. OISC Conventional Distribution Transformer, 15 KVA, single phase, 60 cycle, with side wall mounted high voltage bushings. Standard construction for voltages 5 KV and sizes through 100 KVA.

→ Type CSP. OISC Distribution Transformer, 15 KVA, single phase, 60 cycle, with primary lightning arresters, internal fuses, low voltage circuit breaker and side wall mounted high voltage bushings. Standard construction for voltages 5 KV and less and sizes through 100 KVA.



TRANSFORMERS ARE A
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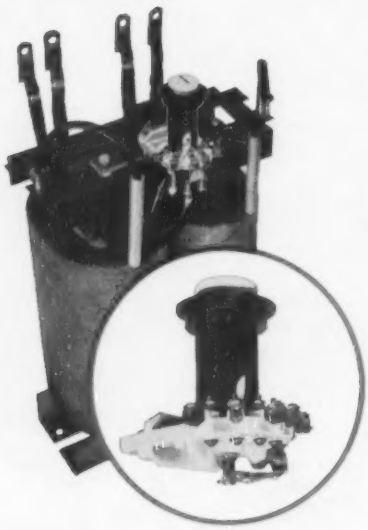
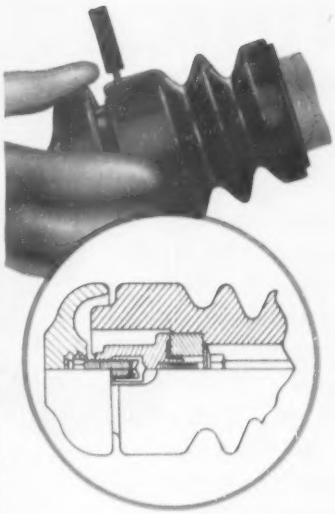


NEW TANK WALL BUSHINGS →

New bushings permit "flick-of-the-wrist" line insertion without tools. No live parts are exposed. Terminal compression stud keeps easy-to-grip, insulated porcelain cap from falling off when unscrewed to receive primary leads. Cables can be brought in from either side and held securely by pressure from the clamping shoe. Makes for faster, safer, easier installations.

← TAP CHANGER SWITCH

Standard's new Tap Changer Switch embodies a contact-making assembly with a brass wheel for positive contact. Normal settings are with 4-tap voltage section. 2½% taps within 10% range of normal rating. Standard supplies transformers with 4 taps above or below, or half above and half below as specified by the customer. This is available at no extra cost to you. Contact-making points are submerged in oil with the handle well above oil level.



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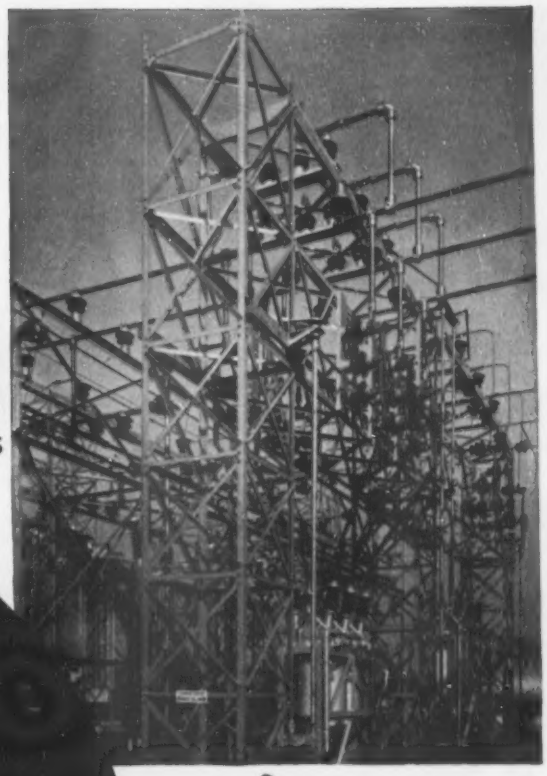

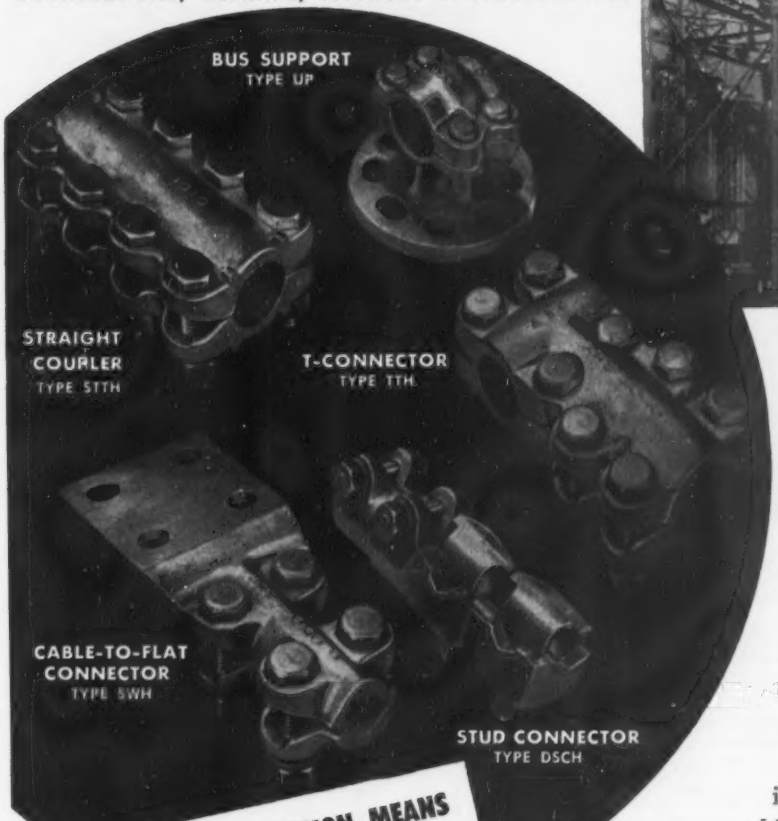

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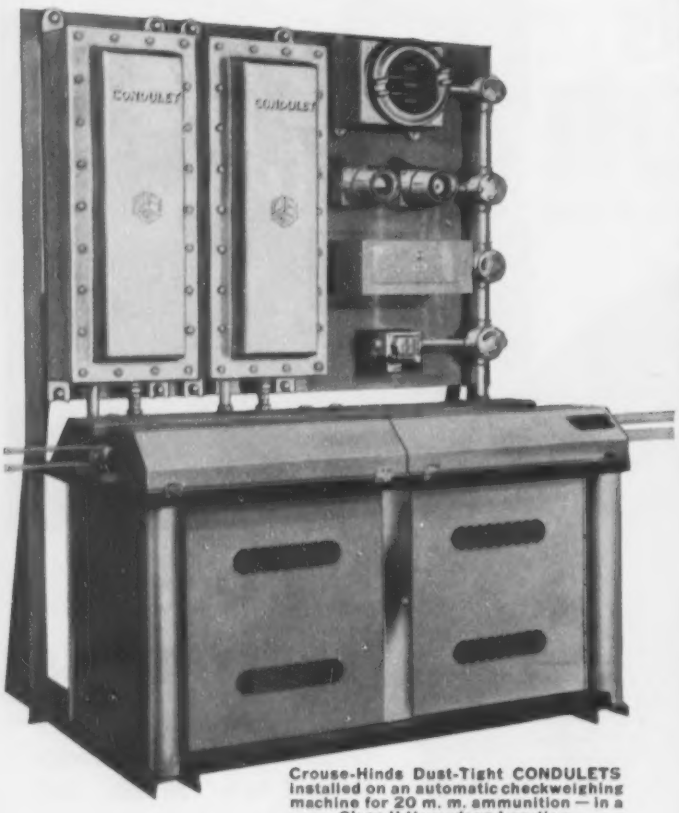
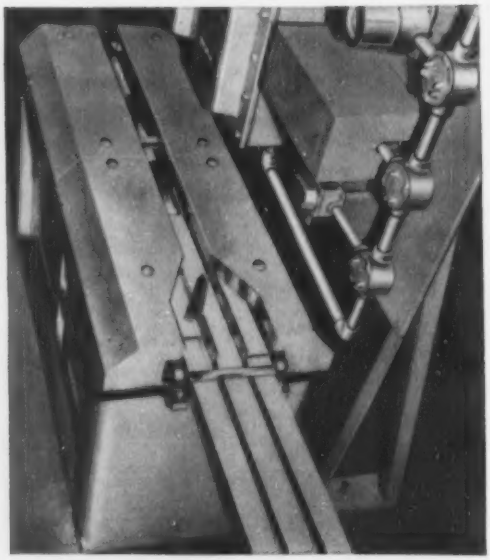
Dust-Tight
CONDULET* electrical installations give you maximum PROTECTION where combustible dusts are present



Crouse-Hinds Dust-Tight CONDULETS installed on an automatic checkweighing machine for 20 m. m. ammunition — in a Class II Hazardous Location.

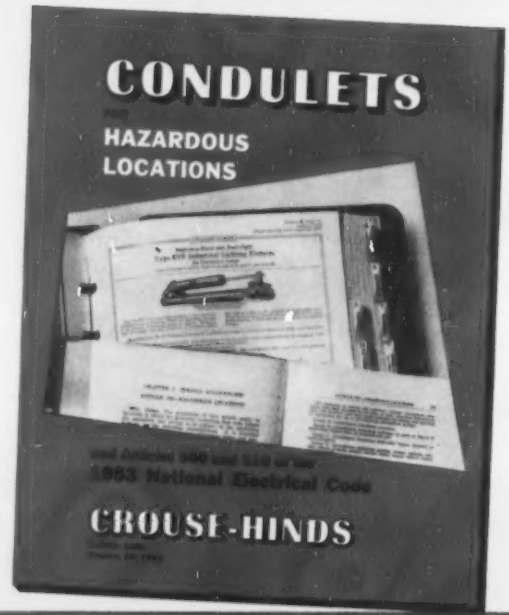


Machines that operate in locations where combustible dust may be present must have electrical installations that meet the requirements of the National Electrical Code. This gives you protection against disastrous explosions and fires and assures uninterrupted service.

For nearly fifty years Crouse-Hinds has manufactured CONDULET electrical equipment of the highest quality, designed to meet Underwriters' Laboratories standards for both ordinary and hazardous locations.

If your machines operate in *any* hazardous location — atmospheres containing flammable gases, vapors, dusts, or flyings — take advantage of Crouse-Hinds offer to send you a FREE copy of Bulletin 2655. It contains a complete copy of the Articles in the National Electrical Code pertaining to hazardous locations, with many useful tables, diagrams, photographs, and suggestions for selecting the correct equipment to meet these Code requirements.

Send for your copy of this valuable reference bulletin today!



*CONDULET is a coined word registered in the U.S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

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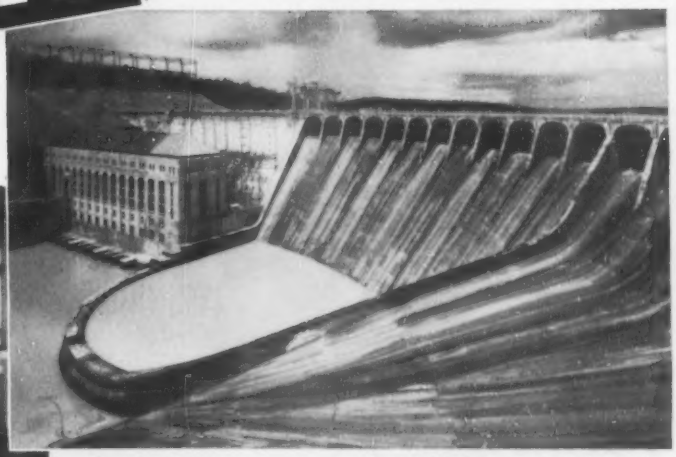
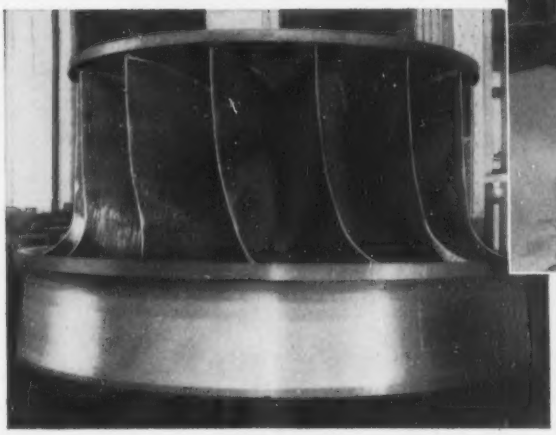
POWER by SMITH

16,000,000 HORSEPOWER

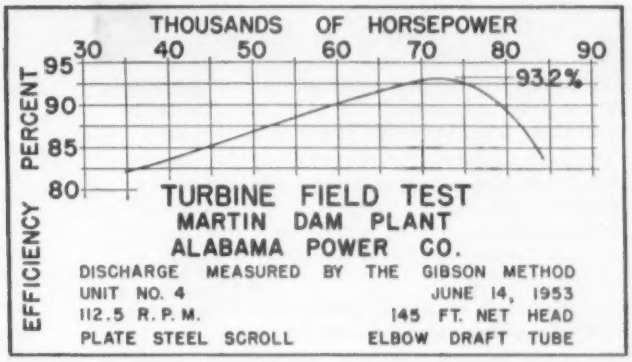


View showing powerhouse extension at Martin Dam for Unit No. 4



SMITH-FRANCIS runner for this installation. Weight 107,700 pounds. Overall dimensions 15'-6" diameter by 8'-7" high. Actual capacity exceeds guaranteed power by 7%. Operation is smooth and quiet.

78,000 HP in a 45,000 HP SETTING



Alabama Power Company wanted to utilize all of the available regulated flow in the Tallapoosa River at Martin Dam. They were gratified to learn that SMITH found 78,-000 HP possible. Restrictions for space and setting were approximately the same as for each of the three existing 45,000 HP turbines.

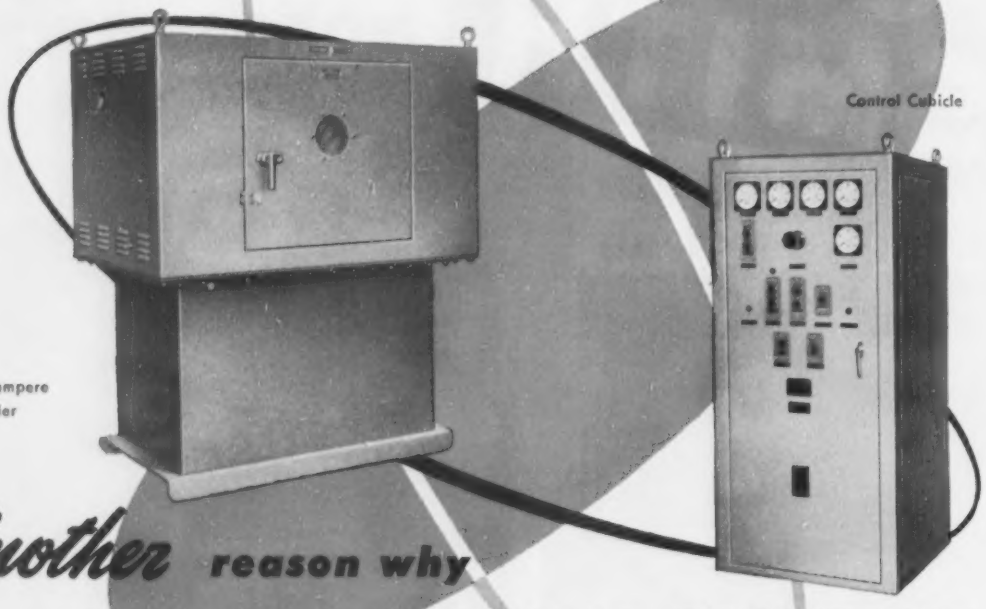
The above test performance data shows 83,800 HP developed during field tests. *This is testimony to SMITH engineering skill and experience.*

S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.

AEROTEC

electronic Kenotron power supply...



Another reason why

AEROTEC ELECTRICAL PRECIPITATORS

require less maintenance

Aerotec Electrical Precipitators provide long uninterrupted service and require *minimum maintenance*. One reason for this is the exclusive electronic power supply developed for Aerotec Electrical Precipitators which provide these advantages:

1. Complete package unit eliminates field installation problems, cage enclosures and ventilating systems.
2. Control cubicle may be placed on boiler operating floor while rectifier is mounted adjacent to the precipitator.
3. Instantaneous overload protection safeguards Kenotron tubes assuring long life.
4. Electronic power supply eliminates noise, noxious and toxic gases commonly associated with mechanical types.
5. No moving parts; nothing to wear, nothing to lubricate.
6. Rugged constant current network control eliminates operator attention.
7. Rectifier available in weatherproof cubicle for outdoor installation.

In addition to more efficient power supply, Aerotec Electrical Precipitators offer higher collection efficiency by:

- Pocket-type collecting electrodes that prevent dust reentrainment.
- Exclusive high voltage flat plate provides a field of uniform high intensity for maximum precipitation.
- Electromagnetic rappers of low intensity impact clear electrodes of deposit on a continuous short interval basis.

For additional data on Aerotec Electrical Precipitators write or call our project engineers—

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 Principal Cities)

Canadian Affiliates: **T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario**

Manufacturers

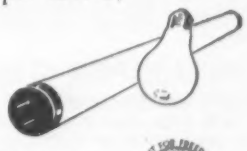
THE AEROTEC CORPORATION

GREENWICH, CONN.

BUG-A-WAY fills extra sockets ... builds summer load

Insects hate the yellow light of Westinghouse BUG-A-WAY bulbs, but people love it. In outdoor sockets, BUG-A-WAY gives virtually pest-free illumination for summer evening comfort. BUG-A-WAY comes in 60, 100, and 150 watt incandescent sizes, plus 20 and 40 watt fluorescent sizes. These popular bulbs are ideal for summer "bonus bulb" promotions.

A complete promotion, built around BUG-A-WAY, is available to you in a 28-page booklet. This booklet also details 10 other load-building plans. For your FREE copy, contact your local Westinghouse Lamp Sales Representative, or write: Westinghouse Lamp Division; Dpt. EW-5; Bloomfield, New Jersey.



YOU CAN BE SURE... IF IT'S **Westinghouse**

Illustrated above are two of the four Triple Reduction Type Herringbone Speed Reducers, specified by the United States Army Corps of Engineers, Portland, Oregon, and furnished to the Monarch Forge and Machine Works, to operate with precise control, four 42′ x 39′ Radial Control Gates at Big Cliff Dam located on the North Santian River, Detroit, Oregon.

Its primary purpose will be to re-regulate the fluctuating discharges effected by the Detroit power plant. The water will be re-used to operate a power plant with an installed capacity of approximately 18,000 kilowatts.

Philadelphia Herringbone Gear Speed Reducers . . . meet all the requirements necessary for positive and economical transmission of power, with simplicity and high efficiency. The gears are arranged symmetrically with respect to the center line of the housing, producing equal loads on the bearings on each shaft, allowing a more compact design.

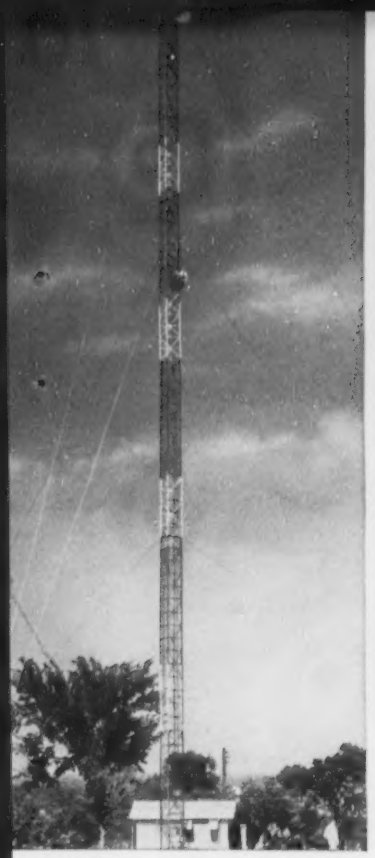
Write for Catalog H-49.

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears & Speed Reducers

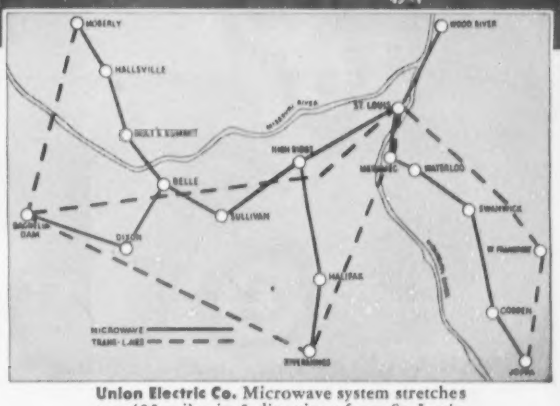
LimiTorque Valve Controls



RCA Microwave radio relay installation at High Ridge, Mo. Towers are rugged, designed to withstand 100-mph winds under severe icing conditions.

Osage Hydroelectric Power Plant installation of Union Electric Company of Missouri, at Bagnell Dam, Mo.—serviced by RCA Microwave.

How UNION ELECTRIC solved today's communication problem



Union Electric Co. Microwave system stretches out 425 miles in 3 directions from St. Louis.

Two years ago Union Electric Company of Missouri ran into the communication problem which sooner or later confronts all growing utilities: their high-line carrier transmission system had become inadequate.

The 150 kc bandwidth, allotted for power line carrier operation, permits the use of only a relatively few channels which are not sufficient to meet all the requirements of a modern communications system. Direct wire lines were ruled out as too costly.

That prompted engineers to adopt Microwave, supplemented with mobile radio at major relay points. RCA Microwave provides channels for remote control of load dispatching, telemetering, teletype and voice communication. It results in close co-ordination of vehicles, field crews, executive and service personnel at outlying offices and stations. And, 70% of the RCA Microwave system is available for future expansion.

RCA Microwave can be interconnected with existing phone lines and switchboards. It uses familiar channeling circuits and readily available tubes. It provides as many channels as needed with minimum use of frequency space.

Now Union Electric has dependable, year-round communications over the full length of its operations. RCA "dish" antennas atop 100- to 300-foot towers, spaced 11 to 46 miles apart, send concentrated beams of radio energy from station to station. The radio beams follow a line-of-sight path—approximately parallel to the transmission lines.

You, too, can plan now for tomorrow's problems—prepare for your expanding communications needs before they develop. The booklet listed below provides quickly digested facts for future thinking, *with no obligation on your part.* Mail the coupon. *Remember,* only RCA can provide the nation-wide service facilities of the RCA Service Company.

RADIO CORPORATION of AMERICA
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

Dept. E45B, Building 15-1

Please send me your reprint describing Union Electric Microwave system, *"Microwave Relines Overcrowded Circuits."*

Name_____ Title_____

Company_____ Address_____

City_____ Zone_____ State_____

☐ Have an RCA representative get in touch with me.

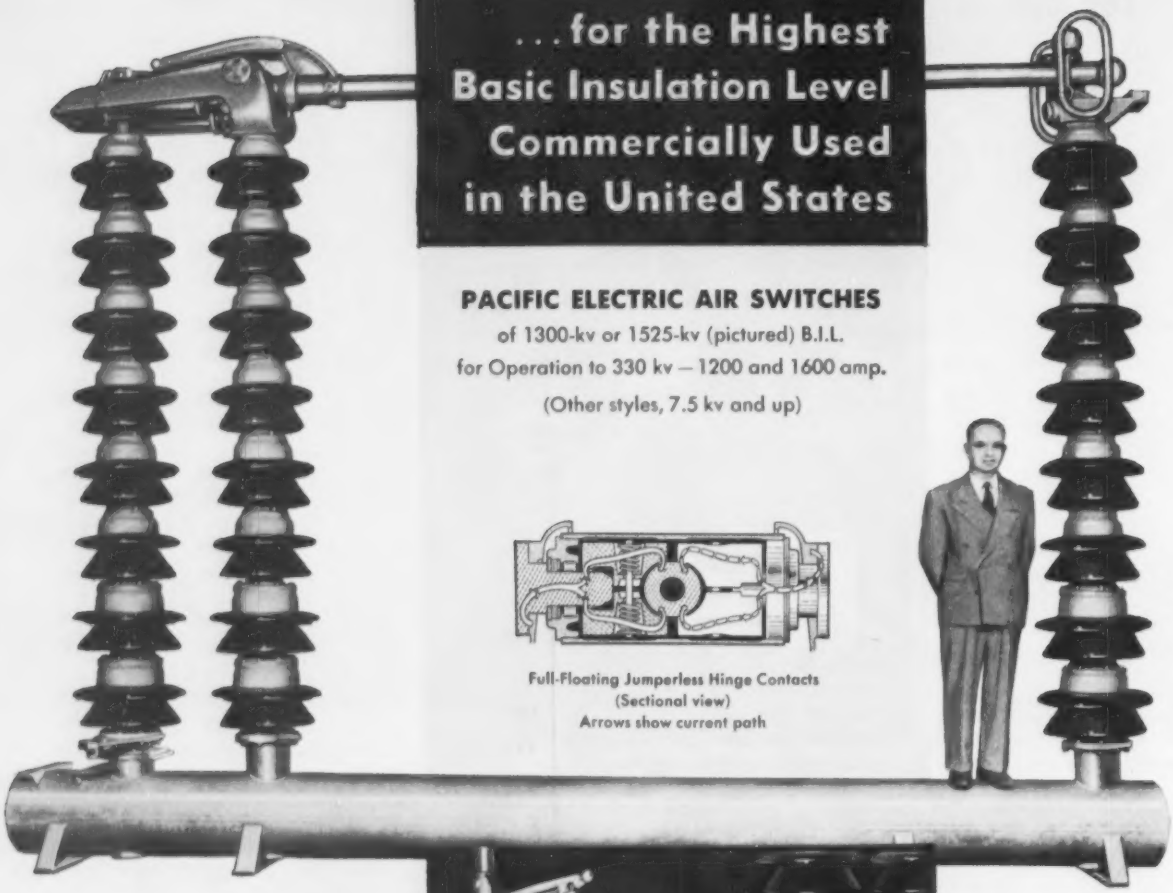
. . . for the Highest Basic Insulation Level Commercially Used in the United States

PACIFIC ELECTRIC AIR SWITCHES

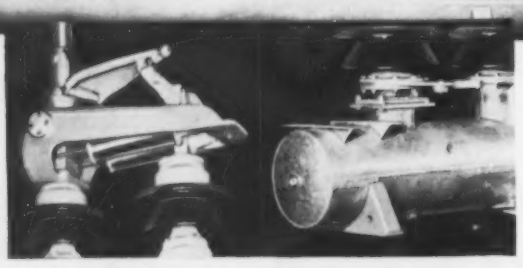
of 1300-kv or 1525-kv (pictured) B.I.L.

for Operation to 330 kv — 1200 and 1600 amp.

(Other styles, 7.5 kv and up)



Full-Floating Jumperless Hinge Contacts
(Sectional view)
Arrows show current path



At left:
Simplified Three-Link Blade Operator

At right:
Cylindrical Anti-Torsion Steel Base

THE PACIFIC Electric Type TG-4 Vertical-Break Air Switch shown in the illustration is a single-pole unit of an order recently completed for a large Western utility. Rated at 1200 amp, 1525-kv Basic Insulation Level, the switch is for operation at 287.5 kv or 330 kv.

Similar switches of 1300-kv Basic Insulation Level—also for operation at 330 kv, as is the practice on some systems—have one less insulator per stack.

The problem of stack rigidity of the insulators—increasingly serious as stack heights mount—is solved by use of a cylindrical base. Its section is ideally adapted to the torsional loading from rotary-insulator operation and from side winds.

OTHER FEATURES, which also apply to all Type TG switches, 115 kv and up

- Solid-silver inserts at opening-end and hinge-end contacts.
- Sealed weatherproof housing encloses full-floating hinge-end contacts. Flexible jumpers are not used.
- Twin counterbalance springs in weatherproof housings assure easy operation at all positions of stroke.
- Roller, ball, and oilite bearings, hardened and ground stainless-steel pins, precision machining, and generous proportioning of parts characterize the mechanical design.

. . . Write for Catalog No. 129 for further information

Since 1906

SALES OFFICES or AGENCIES in PRINCIPAL CITIES

PACIFIC ELECTRIC • MFG. CORPORATION •

SUBSIDIARY OF FEDERAL ELECTRIC PRODUCTS COMPANY

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA

OTHER FACTORIES: SANTA CLARA, CALIF.; SCRANTON, PENNA.

You can simplify purchasing . . . improve design . . . speed production

with improved C-D-F DILECTO® laminates

Only C-D-F, the Continental-Diamond Fibre Company, makes Dilecto laminated plastic, just as only Cadillac makes a Cadillac. Dilecto is 50 different materials with more combinations and variations in desired properties than we can tell you here.

But Dilecto has three important qualities that you should think about if you buy, design, or machine laminated plastics.

DILECTO HAS HIGH MECHANICAL STRENGTH

Mechanical strength is frequently an important determining factor in the selection of an insulating material. Insulating parts used in large electrical power equipment are frequently bulky. The high mechanical strength of Dilecto helps reduce size-dimensions of insulating parts without danger of failure. Instruments, meters and small motors frequently require very small insulating parts which must withstand comparatively large mechanical stresses. Insulation for use in high frequency circuits should have a minimum bulk factor for minimum dielectric losses. Dilecto fulfills these requirements with a combination of high mechanical strength and low loss factor, characteristic of the better C-D-F electrical grades.

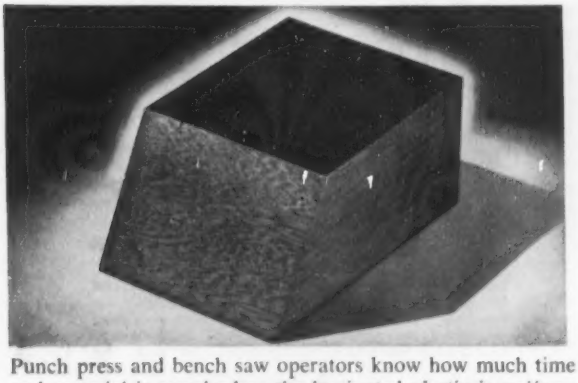
So C-D-F selects for your Dilecto insulation grade the correct, highest quality base material, paper, cotton, nylon, glass. These are used in combination with improved penetrating resins: Improved Phenolic, New Melamine, New Silicone, New Teflon, all synthetic, well polymerized resins.

Both the base and the resin are good insulators by themselves. But C-D-F sells them to you in an improved, practical form . . . Dilecto. Uniform sheets, tight tubes, strong rods, close tolerance machined and formed specialties, high bond strength metal clads.

Why does Dilecto combine so well mechanical strength with dielectric strength and dimensional stability? Because Dilecto is almost homogeneous, a true blend of resin and base.

DILECTO IS ALMOST HOMOGENEOUS

A poor laminate absorbs moisture at its edges, loses its insulating properties fast. Entrapped moisture and other volatiles within the cured structure causes inconsistent dielectric strength, with ultimate puncture and breakdown.



Punch press and bench saw operators know how much time and material is saved when the laminated plastic is *uniform* and *homogeneous* in nature like Dilecto.

DILECTO IS IMPROVED

Yes, C-D-F Dilecto is an improved laminated plastic, due to high standards and advances in resin and manufacturing techniques. It is watched by skilled workers in our modern plants, checked against rigid standards . . . C-D-F standards . . . by our quality control people. It is easy to machine, and the C-D-F shops are doing a booming business in specialties.

Table I—Typical Improved Phenolic Laminates

Commercial designation[a]	Resin	Filler	Improved properties	Improvement due to:
MEC-5	Phenolic	Nylon fabric	Insulation resistance; moisture resistance	Filler
XXHV-2[b]	Phenolic	Paper	High dielectric strength parallel to laminations	Resin and manufacturing technique
CRD	Phenolic	Cotton mat	Better machining	Filler
XXXP-26[b]	Phenolic	Paper	Insulation resistance; moisture resistance	Resin and manufacturing technique
C-92	Xylenol[c]	Cotton fabric	Alkali resistance	Resin
CF	Modified phenolic	Cotton fabric	Postforming	Resin

[a] All grades are Continental-Diamond Fibre Company.
[b] Resins have improved penetrating properties and the manufacturing techniques use these properties to provide better impregnation of the filler. Since thorough impregnation eliminates entrapped moisture and air, greater moisture resistance and better dielectric properties are attained. Manufacturing techniques also provide suitable temperature control during the curing stage to assure uniform quality and optimum property values in the finished laminate.
[c] Xylenol is essentially a dimethyl phenol.

—from Electrical Manufacturing Article "Wider Design Opportunities with the NEW Phenolics", Part II.

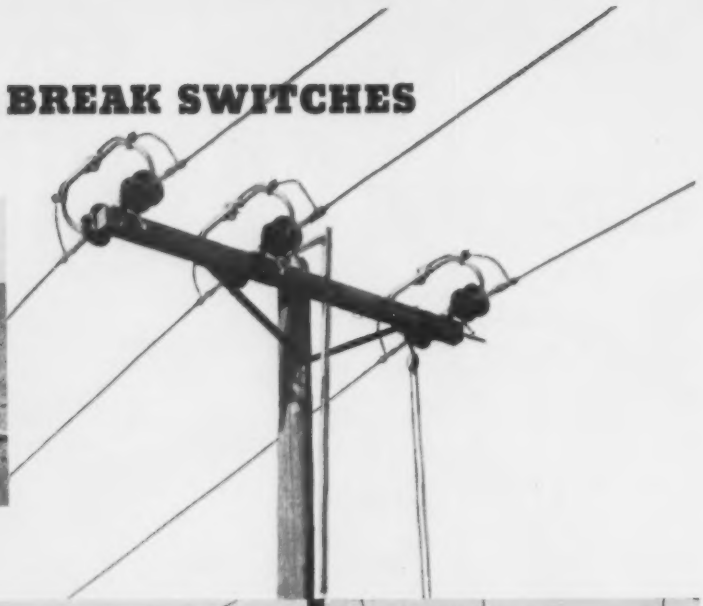
The next time you think of laminated plastics, the name to remember is C-D-F Dilecto. The improved, high strength, uniform material that makes insulation buying and using more a science, less a puzzle. New grades, new applications, new savings are just part of the Dilecto success story. Look up the facts in Sweet's Design File, or write for catalog. Send us your blueprint for quotation . . . tell us your design dream . . . C-D-F wants to work with you.

CDF *Continental-Diamond Fibre*

CONTINENTAL-DIAMOND FIBRE COMPANY
NEWARK 15, DELAWARE

KPF AIR BREAK SWITCHES

1 Sturdy factory-assembled phase units are bolted to cross-arm and push-pull interphase control rods installed on the ground. (Installation is equally simple in the air on installed cross-arms.)



2 At pole top, linemen receive switch bolted to cross-arm and ready to install on pole. Simple design and use of quality materials means KPF phase units are rugged, yet amazingly light weight.

3 Cross-arm bolted to pole, braces and first section of control rod installed. Linemen connect conductors quickly and easily to any standard strain clamp and dead-end direct to phase units.

4 Conductors connected, crank arm being adjusted on push-pull interphase control rod. Like KPF switches and Quick-Breaks, KPF controls need no lubricating. They crack off any icing, are never affected by cross-arm warpage.

Time-tested KPF switches install simply, easily—in 1/2 normal time

KPF switches—the switches that look different because they *are* different—install differently, too. Experience of leading Western power companies shows that KPF switches are normally installed in ½ the time required for complex, cumbersome ordinary equipment. Each KPF phase unit is light weight, readily handled by one man. No extra cross-arms or special supporting structures are needed. Each phase unit is fully assembled, tested and adjusted at the factory. The unit is ready to operate when it reaches the job—no waste of lineman's time. Dependable KPF switches may be mounted horizontally, vertically or triangularly with equal success and long-term, trouble-free service.

For the world's simplest, surest, lowest cost air break switch, specify KPF—standard for nearly 50 years.

KPF
AIR BREAK SWITCHES
Standard for nearly half a century

New catalog gives complete specifications, detail drawings, installation data.

5 Installation complete. Lineman installs operating lever and last section of control rod. Note the neat, clean pole top appearance of KPF switches—a familiar sight throughout the West on such famous systems as PG&E, Southern California Edison and others.

KPF ELECTRIC COMPANY
1624 East Alpine Avenue, Dept. E-4, Stockton 5, California

Sangamo presents a NEW Singlephase Watthour Meter
– the Type J2 – the finest in Sangamo history

EXTENDED RANGE... The new J2 assures accurate measurement to 100 amperes, without sacrifice of performance at light loads. This provides sufficient reserve capacity to meet any contingency of future load growth.

EXTENDED STABILITY OF CALIBRATION... The J2 offers unusually long sustained accuracy of calibration because it has the lowest disk speed and highest torque of *any watthour meter* today.

EXTENDED MECHANICAL STABILITY... The J2 features improved corrosion-resistant finishes and materials to assure better and longer performance under even the most severe atmospheric conditions.

please turn page

also . . . the NEW Sangamo Type J2T Watthour Thermal

DEMAND METER

The J2T is also supplied with a 12 KW scale for power companies who measure demands on smaller loads and who want indications above ¼ to ⅓ scale.

Write for complete information on these cost-cutting demand meters today.

for *Greatly Reduced* Demand Measurement Costs

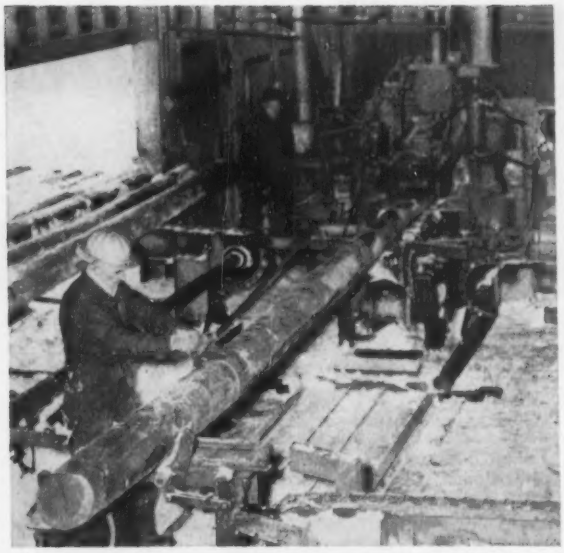
The Sangamo J2T watthour thermal demand meter takes full advantage of the extended range of the new J2 meter by extending the scale of this 15 ampere meter to 24 KW, at the same low price as its predecessor, the Sangamo JT. Power companies whose practice calls for measurement of demands in excess of 10 KW can use the scale of the 15 ampere J2T to cover loads which previously have required 50 ampere meters. Measurement costs are thus substantially lowered for the largest group on which demands may be measured.

SANGAMO

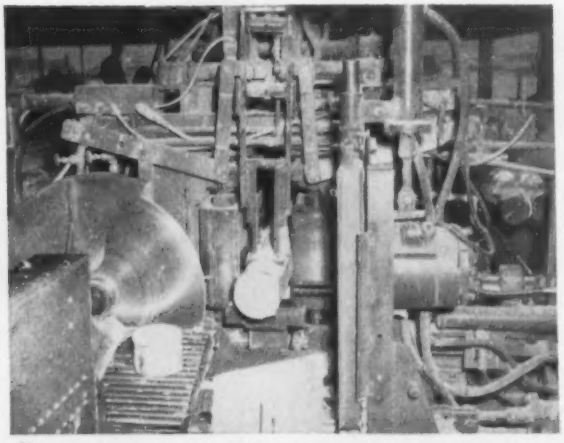
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JM54-2



1. Inspection. Incoming skids where poles are checked for size and quality.



2. Precision Framing. This mechanical unit performs roofing, gaining and boring in *one* operation.

3. Inspection and Branding. Movable inspection skids allow for complete observation of poles, and for branding.

NO CHANCE FOR ERROR HERE

Precision Framing... One of the Quality Features of J. Neils DOUBLE-LIFE Treated Poles

At J. Neils, precision framing takes the guess-work out of pole roofing, gaining and boring. All operations are done simultaneously by machinery. Gains are uniform. Distance between holes is exact. Holes are straight.

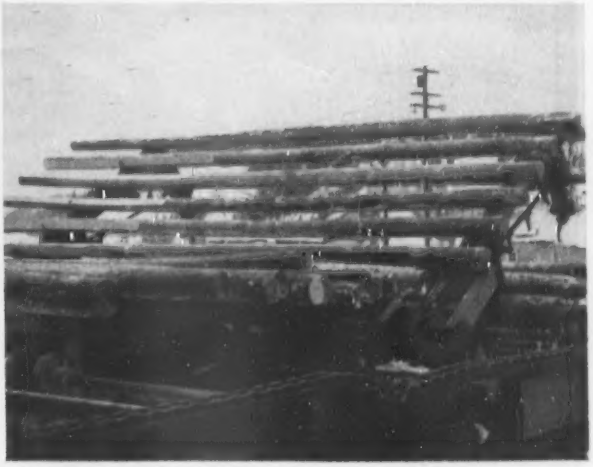
In addition, pole handling from inspection, through framing machine to loading, is 100% mechanical. No skidding, dragging or rolling. No roughing up or degrading of pole quality.

These hidden values are important manufacturing details that insure satisfaction, long service, low maintenance.

Your inquiry for literature or other information will be given prompt attention.

J. Neils Lumber Company

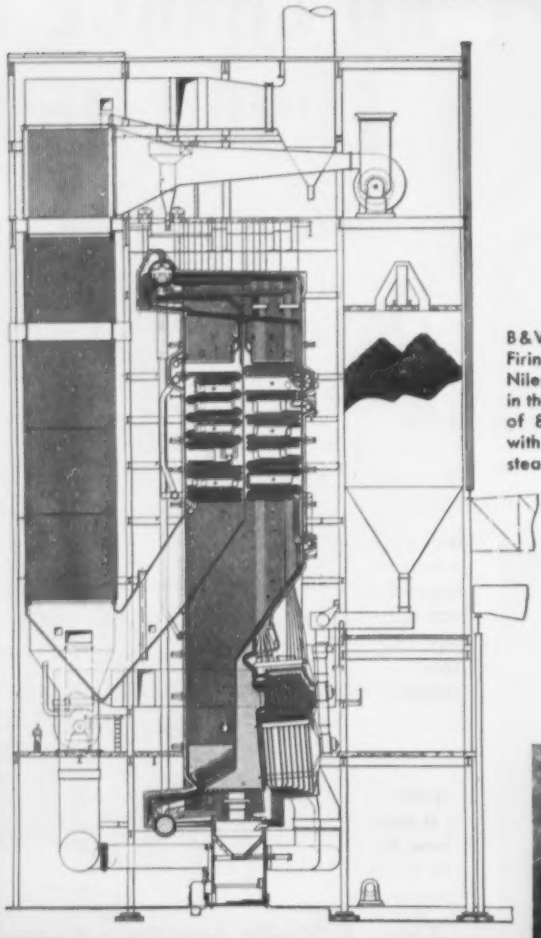
Pole Division: Libby, Montana



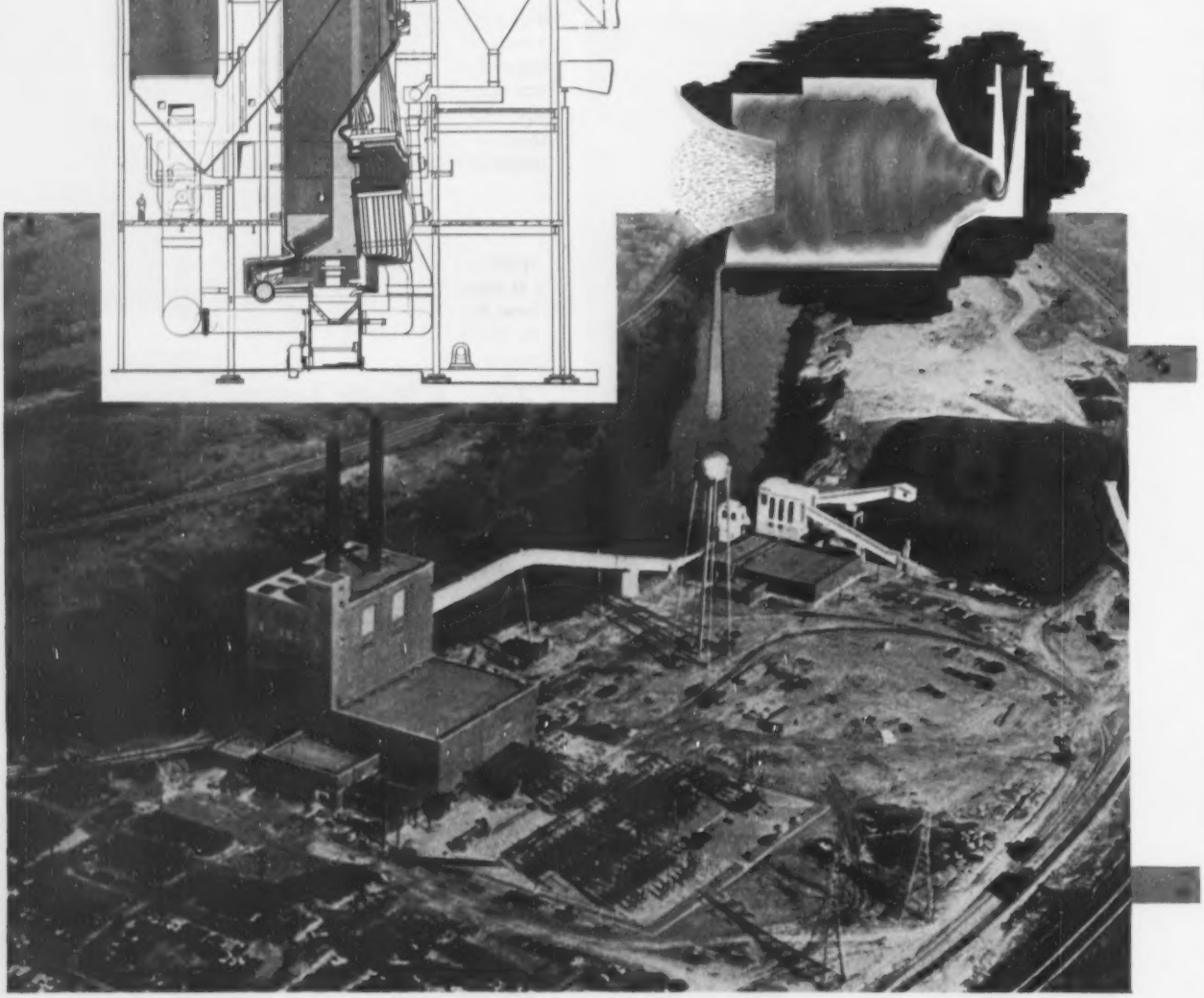
4. Loading. Poles are loaded on tram cars from inspection skids by a mechanical arm loader.

New **B&W** *Pressurized,*

on the line at



B&W Radiant Boiler with Cyclone Furnaces, Pressure-Firing, Cyclone Steam Separators and Reheat for the Niles Station of Ohio Edison Co. Each of the two units in this station has a maximum continuous steam capacity of 885,000 lb per hr. Design pressure is 1650 psi, with pressure at superheater outlet 1485 psi. Final steam temperature is 1000 F with reheat to 1000 F.



Cyclone Furnace Boiler

NILES STATION

Reflecting the need for additional power facilities in the area it serves, Niles Station is a tribute to the foresight of executives of Ohio Edison Company and its consulting engineers, Commonwealth Associates, Inc. Built into this new station are many technical advances to achieve economical construction costs while assuring efficient long-range power generation. For example, the two B&W Boilers for Niles Station, the first of which is now on the line, incorporate such engineering features as:

- Cyclone Furnaces for efficient use of low grade coals, with provision for burning oil or gas when conditions warrant.
- Pressure-Firing, with elimination of induced draft fans.
- Cyclone Steam-Separators for natural circulation and high-purity steam to the turbine.
- High superheated and reheated steam temperatures.

Elimination of Heavy Fly-Ash Discharge with Cyclone Furnaces

Cyclone Furnace Boilers offer many advantages. One important feature is the elimination of heavy fly-ash discharge from the stack. Most of the ash from the burning coal is melted into easy-to-handle slag right in the Cyclone Furnace. This ash never gets into the gas stream, with the result that dust loading to the stack is reduced to very small amounts . . . *often less than that specified by dust loading codes.* The Cyclone Furnace offers many other benefits. Through simplification of the entire process of coal preparation, combustion, ash segregation, and ash handling, it makes possible economies in initial cost, operating labor and fuel consumption. Maintenance costs are cut because so much maintenance-causing machinery is eliminated.

Higher Efficiency, Less Maintenance Through Pressure-Firing

Lower fuel consumption, easier operation, and less maintenance are made possible by pressure-firing and the elimination of induced draft fans. There is also a savings in auxiliary power consumption since the forced draft fan alone requires less power than that needed for a combination of forced and induced draft.

Positive Circulation, Clean Steam with Cyclone Separators

Adequate circulation of water throughout the unit is assured with safety by B&W's efficient Cyclone Steam Separators. Located inside the drum, these simple, stationary devices require no power, need no maintenance, do not take up building room. In conjunction with Steam Scrubbers, the Cyclone Separators make it possible to send steam of highest purity to the turbine, contributing to greater turbine efficiency and decreasing the amount of turbine cleaning required.

* * * * * * * * * * *

These and many other modern advances in combustion and high-pressure, high-temperature steam generation are available to you. We will be glad to discuss them with you in connection with your future plans. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

BOILER DIVISION

G-629

Never underestimate the power used by these appliances

Crosley and Bendix are leaders in the production of customer-satisfying and power-consuming home appliances. Consolidated, they provide a single source for *all* major appliance requirements.

Here are a few of the outstanding Crosley and Bendix appliances that will help you sell power:

Bendix Duomatic Washer-Dryer—the only product of its type on the market. Washes and dries clothes in one operation. Extremely popular because it saves space, installation costs.

Crosley *Super* Shelvador® Refrigerators—with exclusive Deep Door Design. Automatic Beverage Server and Roll-out Interior for added convenience. Fully automatic defrosting, full-width freezer.

Crosley Electric Water Heaters—round or table-top models. Completely automatic. Custom models provide magnesium-anode protection against corrosive elements in the water.

Crosley Electric Ranges—all with divided-top design. Push-button surface controls, 7-heat surface units. Self-sealing oven doors.

Crosley Room Air Conditioners—with the exclusive Climate Timer, which gives *automatic heating as well as automatic cooling.*

Crosley Dishwashers—SwirlClean Action with revolving tray eliminates hit-or-miss washing. Drying action is completely automatic.

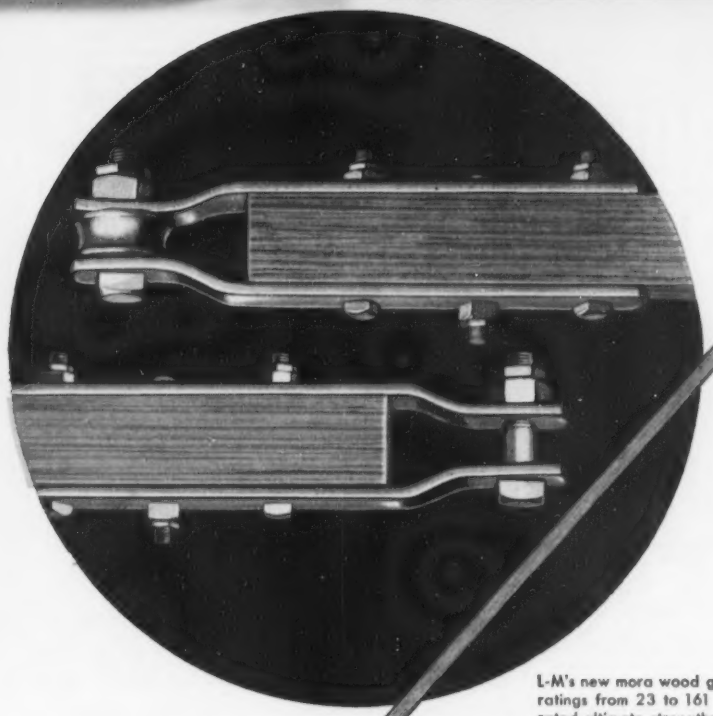
Crosley and Bendix make and promote every major appliance available, including radio and television. Consolidated Crosley and Bendix distributors will be glad to assist you in *your* promotions. Why not contact your distributor or write direct to: Utility Department, Appliance and Electronics Division, AVCO Manufacturing Corporation, 1329 Arlington Street, Cincinnati 25, Ohio.

APPLIANCE AND ELECTRONICS DIVISION

CROSLEY AVCO Cincinnati 25, Ohio **BENDIX**

APPLIANCES • TELEVISION • RADIOS

AUTOMATIC HOME LAUNDRY



L-M's new mora wood guy insulators come in ratings from 23 to 161 kv, in conservatively rated ultimate strengths of 15,000, 25,000, and 35,000 pounds. Mora is extremely low in moisture absorption, highly resistant to fire and shattering; is dense and very strong, and provides an insulator with extremely long life. Mora wood insulators are provided with galvanized steel end-plates, with bolt at one end, and one or two rollers for guy strand at the other.

New L-M Mora Wood Guy Insulators Resist Shattering and Burning

New wood from equatorial tropics has extremely low rate of moisture absorption, high tensile strength.

In the jungles of South America, along the equator, grows the mora tree, which provides an unusual type of wood. Mora wood has been used extensively in dock and pier construction, in warehouse flooring and shipbuilding, because of its extreme strength and toughness and its low rate of moisture absorption.

These qualities make mora wood a most desirable material for guy strain insulators. Mora's natural resistance to all types of decay puts it in the same class as pressure-treated domestic woods—yet it needs no treating.

Low Moisture Absorption

Air-dried samples of mora and fir with a moisture content of 12% were submerged for 10 hours. At the end of that period the mora wood samples averaged 16% moisture content, while the fir samples averaged 30%. In a 24-hour test of oven-dried samples, mora absorbed only 9.8% of its oven-dried weight, while fir absorbed 40%.

Resists Shattering

Mora is slow burning. It has great ability to resist the damaging effects of surges. We take advantage of this fact to eliminate arcing horns from the insulator, allowing cleaner, safer construction of guyed installations. Mora insulators are designed to provide an impulse strength approximately twice the BIL of each rated voltage class. Mora wood weighs about 65 pounds per cubic foot. It is about three times as hard as Douglas Fir.

Mora has far higher resistance to shattering on impulse tests than fir. A steep front wave with a crest value of 340 kv was applied to 12-inch lengths of both mora and fir. After a given number of shots, varying from 1 to 5, the fir split along the grain so badly that no mechanical strength remained. The mora wood samples showed some fibre shredding on the surface, but even after six shots the mora was still sound and retained nearly 100% of its mechanical strength.

Sizes and Ratings

Mora guy strain insulators are available in 15 sizes, in voltage classes from 23 to 161 kv, with ultimate strength ratings of 15,000, 25,000 and 35,000 pounds. Lengths for these ratings range from 4 ft. 6¼ in. to 13 ft. 10¼ in. All sizes are provided with hot-dip galvanized steel metal plates bolted to the wood members, with through bolt at one end for pole attachment, and roller at the other end (2 rollers on 35,000-pound strength insulator) to reduce wear on guy strand.

Get Complete Information

Ask the L-M Field Engineer to show you a sample of mora wood and give you a complete list of ratings and sizes available. Or write Line Construction Material Division, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LINE MATERIAL

Line Construction Materials

LET'S LOOK AT THE FACTS

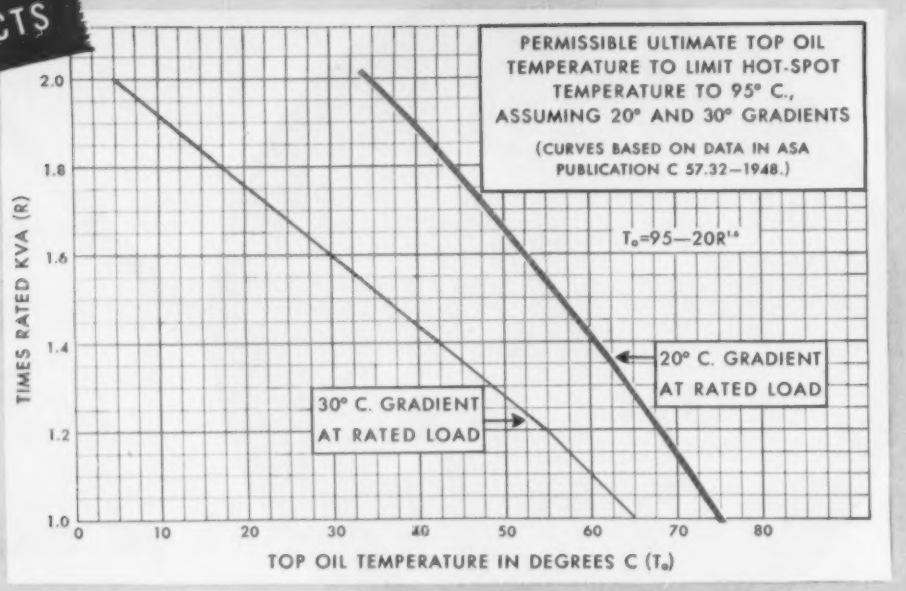


FIGURE 1—The colored line represents the conservative performance typical of a core-type transformer with highly efficient cooling such as the L-M Round-Wound, while the black curve represents the loading permissible with a transformer with less efficient cooling. These are ultimate oil temperatures. Because of efficient dissipation of heat from the coils to the oil, the oil reaches its ultimate temperature more rapidly in L-M Round-Wounds than in some other styles of construction.

How L-M Round-Wound Design Permits Heavier Loading or Longer Transformer Life

Round coils wound directly onto a wound core provide exceptional cooling that keeps copper and hot-spot temperatures relatively low even under high short-time overloads.

by **ROBERT P. THOMPSON,**
Assistant Chief Engineer,
Transformer Division,
Line Material Company

Greater transformer utilization through heavier loading offers substantial savings on almost any power system. Therefore the subject of transformer loading is receiving exceptional attention, both from utility companies and from the manufacturers.

Overload capacity of any individual transformer depends upon such factors as ambient temperatures, previous condition of loading, duration of the overload, and the sacrifice in transformer life that the user is willing to make.

But the principal factor is the transformer itself. Since overload capacity is limited by hot-spot temperature rise during the overload period, this capacity is largely determined by the design of the coils and the efficiency with which heat can be dissipated to the oil.

Obviously a core-type transformer, which has greater coil surface exposure, offers better overload capacity than shell types, in which coil surfaces are blanketed by core steel.

Round coils offer greater overload capacity than rectangular coil types, because coils present more unobstructed surface to cooling oil.

The Round-Wound transformer combines the advantages of the core-type transformer with the rapid heat dissipation of unobstructed round coil surfaces —and offers, in addition, the advantages of the cruciform-cross-section core, which provides natural oil passages for cooling the inside of the coils. Thus in the Round-Wound transformer, heat is dissipated *more rapidly* and more uniformly. For this reason the Round-Wound design provides higher short-time overload capacity, or a longer life with the same overload (Figure 3).

Get Details on L-M Round-Wound Transformers

Ask the L-M Field Engineer, or write Mr. Thompson at the Transformer Division, Line Material Company, Zanesville, Ohio (a McGraw Electric Company Division).

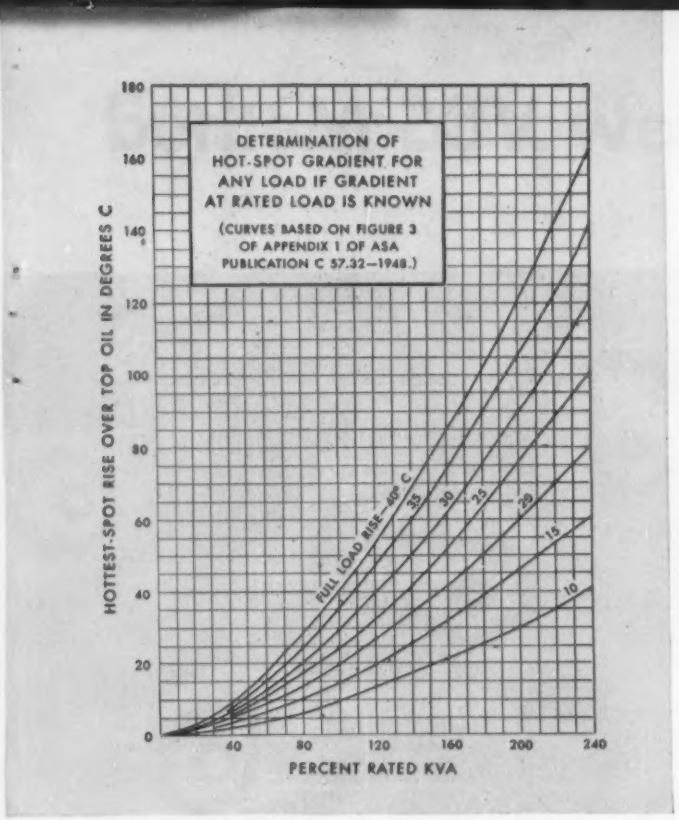


FIGURE 2—Here is presented a method of determining the hot-spot gradient for any load, if the gradient at rated load is known. It is to be noted that the higher the gradient at rated load, the more rapid is the rate of increase in the gradient with overload. The L-M Round-Wound transformer with a lower hot-spot gradient at rated load has a greater capacity for overload before damaging temperatures are reached.

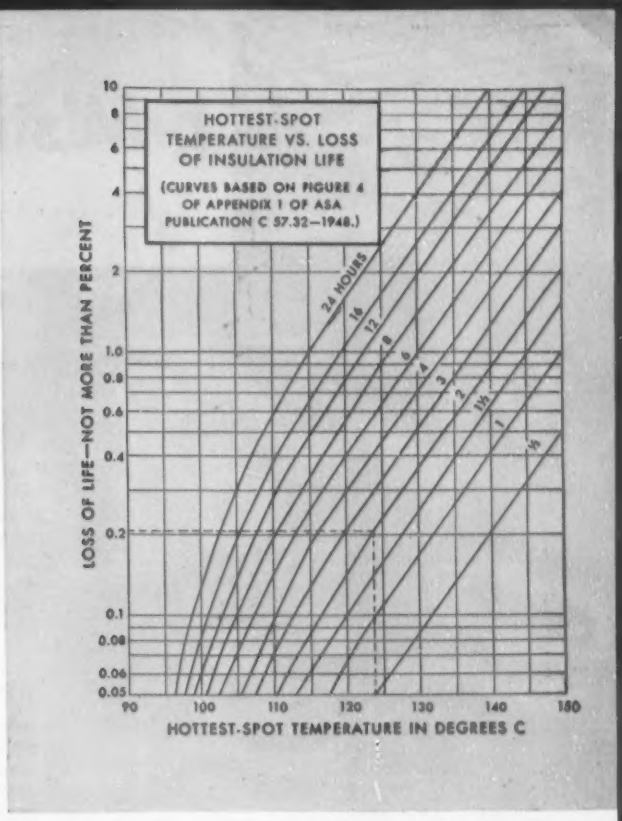


FIGURE 3—The primary factors in the deterioration of cellulosic insulation are time and temperature. Here is a method for approximating the loss of insulation life due to these two factors. Obviously an L-M Round-Wound transformer with its appreciably lower hot-spot temperatures during overloads will reduce the possible insulation damage and increase the overall life.

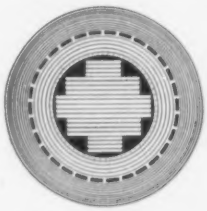


FIGURE 5—Cruciform cross section of the wound core provides oil passages between core and coils. In addition spacers between windings and between layers in larger sizes provide additional oil circulation, giving exceptionally good cooling for the entire unit.

Some of the Outstanding Characteristics of L-M Round-Wound Transformers

High Short-Time Overload Capacity

Better Regulation at all power factors

High Impulse Level, with ample creepage distances and generous insulation

High Short-Circuit Strength, because round coils have less tendency to distort

Low Exciting Current, because the core is not cut or disturbed after annealing

Better Loss Ratios with lower total losses

Filled with ORTO®, L-M's oxidation-resistant transformer oil, inhibited for longer life.

"Round-Wound" is a Line Material Co. trademark.

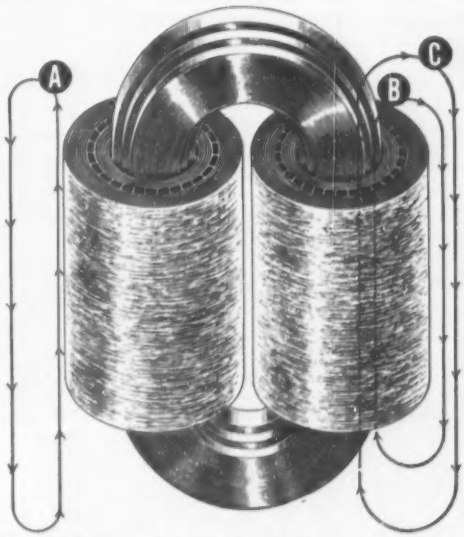
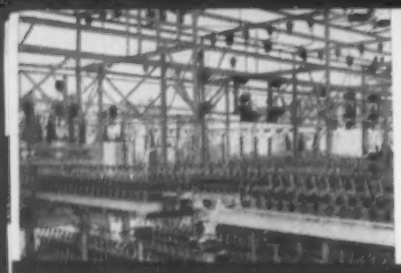


FIGURE 4—Diagrammatic presentation of the Round-Wound core-coil assembly. The core is wound of continuous strip of oriented silicon steel of various widths to give a core of cruciform cross section. Core is not unwound or cut, because coils are wound directly onto the completed, annealed core. Coils surround a maximum of the core circuit. They present a relatively large area to cooling oil.

LINE MATERIAL Transformers

Complete Coordinated Equipment for Distribution Today



L-M's New VDS Method

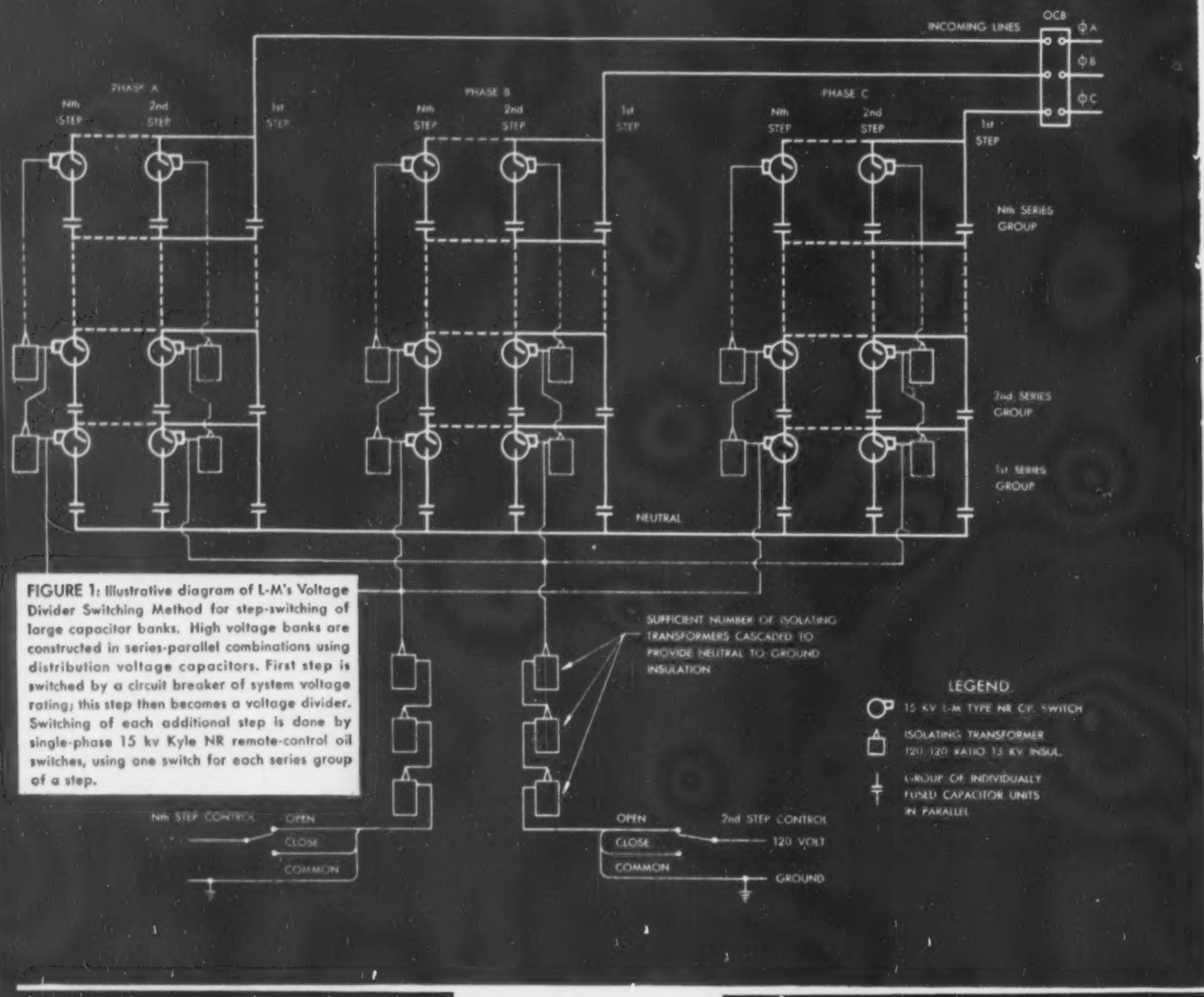
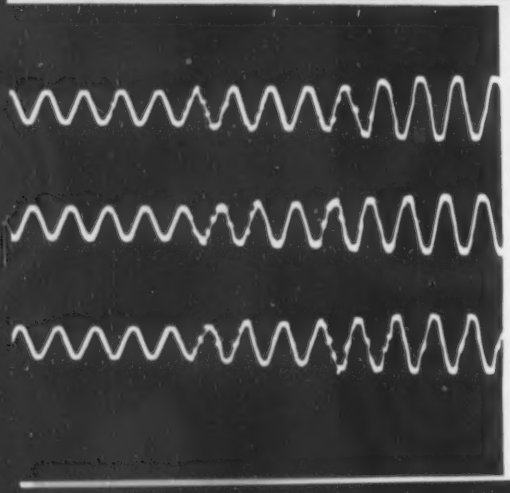


FIGURE 1: Illustrative diagram of L-M's Voltage Divider Switching Method for step-switching of large capacitor banks. High voltage banks are constructed in series-parallel combinations using distribution voltage capacitors. First step is switched by a circuit breaker of system voltage rating; this step then becomes a voltage divider. Switching of each additional step is done by single-phase 15 kv Kyle NR remote-control oil switches, using one switch for each series group of a step.



Oscillograms show that the random operation of a number of switches, all within approximately ½ second, eliminates any system disturbance. Figures 2 and 3 show the switching on and off of a 5250 kvar step of capacitors at 46 kv by 21 Kyle oil switches comprising seven series groups per phase. The current increases or decreases smoothly as the 21 switches operate at random times.

FIGURE 2—ON

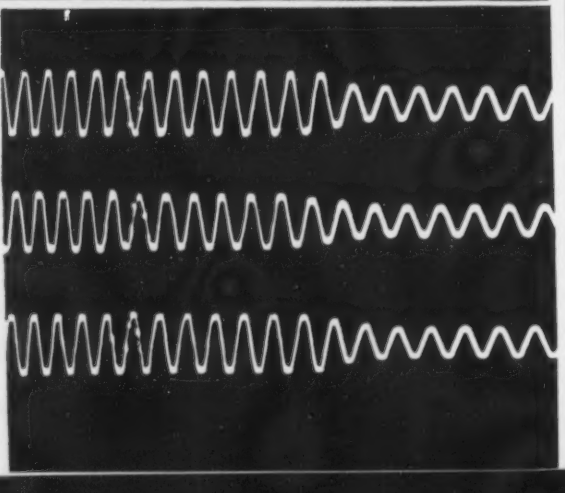


FIGURE 3—OFF

Cuts Capacitor Switching Costs 40%

L-M develops low-cost method of switching large multi-step capacitor banks. Known as the Voltage Divider Switching Method (patent applied for), this method permits substituting low-cost 15 kv oil switches for circuit breakers on all but the first step of multi-step banks from 23 to 230 kv.

by **P. M. MINDER**
Application Engineer
Line Material Company

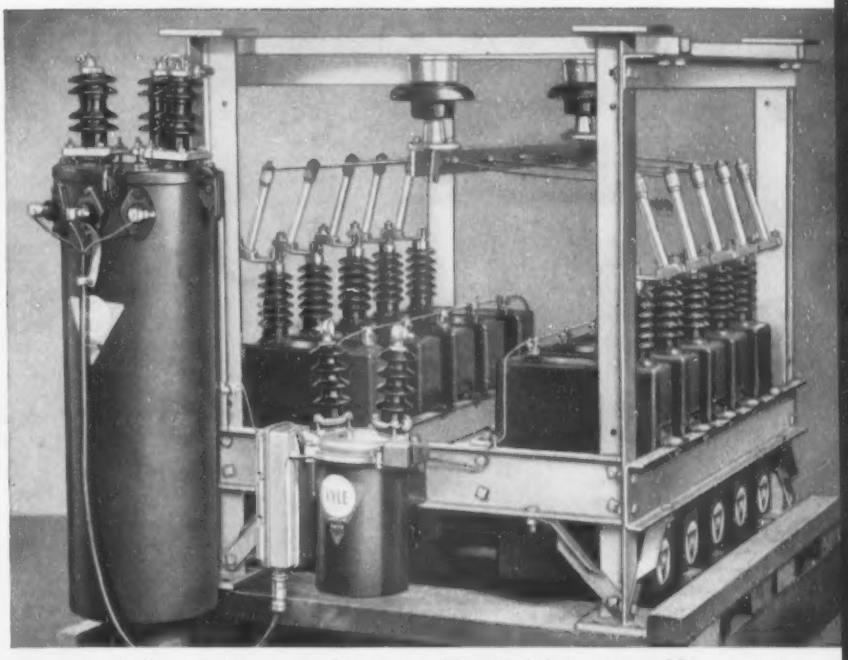
With the trend toward installation of capacitors on transmission and subtransmission circuits, capacitor switching has become a problem of economics. Large banks sometimes must be switched in a number of steps. The conventional practice requires a large breaker for each step. Thus the cost of switchgear for these large multi-step banks may become prohibitive.

L-M's Voltage Divider Switching Method utilizes L-M's Kyle NR remote-control 15 kv oil switches on all but the first step of a large bank. While a number of these switches are required, they cost only about $100 each, and even a number of them cost far less than a large breaker.

Cost Cut 40%, For Example

Here is an example of the comparative cost of switching by the conventional method and the VDS Method. Figures are based on a bank rated at 69 kv, 15,750 kvar, with 3 steps, each 5250 kvar.

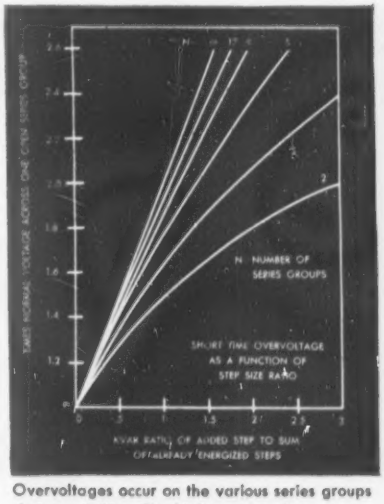
Figures include cost of switching equipment only. They do not include cost of automatic control equipment in either case. Nor do they include cost of installation, or the saving in foundations for two additional large breakers. It is evident that, in any case, the use of the VDS Method offers substantial savings. Discussion with one of the L-M Field Engineers will help you arrive at reasonably close figures for any individual application.



L-M's new factory-assembled stacking unit. The unit includes ten or more 25 kvar capacitors and the required fuses, Kyle NR switches, and isolating transformers mounted on the end of the frame. These stacking units are available in sizes from 250 to 600 kvar.

Figures Show What You Can Save With L-M's VDS Method

Conventional Method:	
1 OCB, 2500 MVA interrupting capacity; cost, about	$20,000
2 OCB's, 1000 MVA interrupting capacity; cost, about $13,500 each	27,000
Total, about	$47,000
Voltage Divider Switching Method:	
1 OCB, 2500 MVA interrupting capacity; cost, about	$20,000
2 switched steps using 30 Kyle NR switches (15 in each step) and equipped with all necessary isolating transformers and insulators; cost, about	8,400
Total, about	$28,400
Saving, VDS Method over conventional, about	$18,600


N = NUMBER OF SERIES GROUPS
SHORT TIME OVERVOLTAGE AS A FUNCTION OF STEP SIZE RATIO
KVAR RATING OF ADDED STEP TO SUM OF ALREADY ENERGIZED STEPS

Overvoltages occur on the various series groups during switching. The highest overvoltage occurs when all but one switch of the second step are closed. These overvoltages are of brief duration and are kept at a safe magnitude by proper bank design.

Get Complete Information—Details of the new L-M Voltage Divider Switching Method (patent applied for) are available in a technical paper. Ask the L-M Field Engineer for a copy, and for information about L-M's Capacitor Application Engineering Service. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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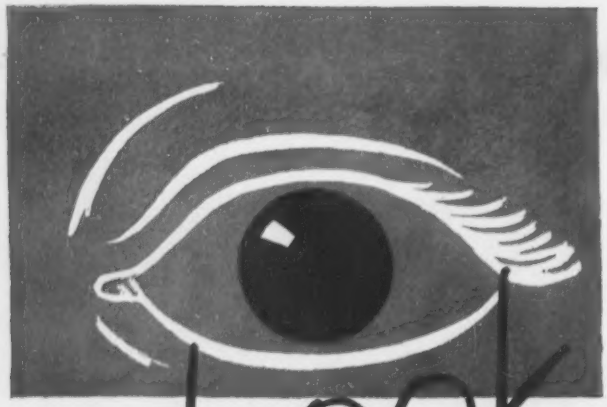
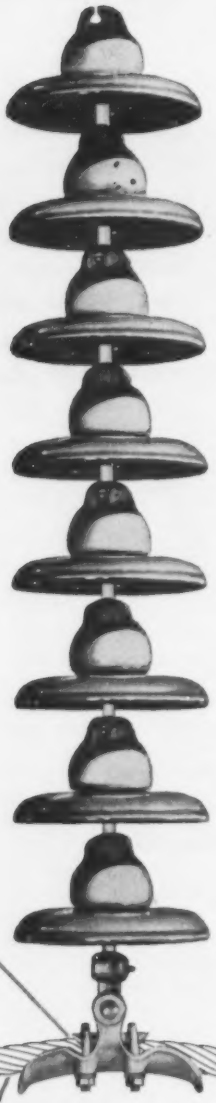
LINE MATERIAL *Elemex Capacitors*



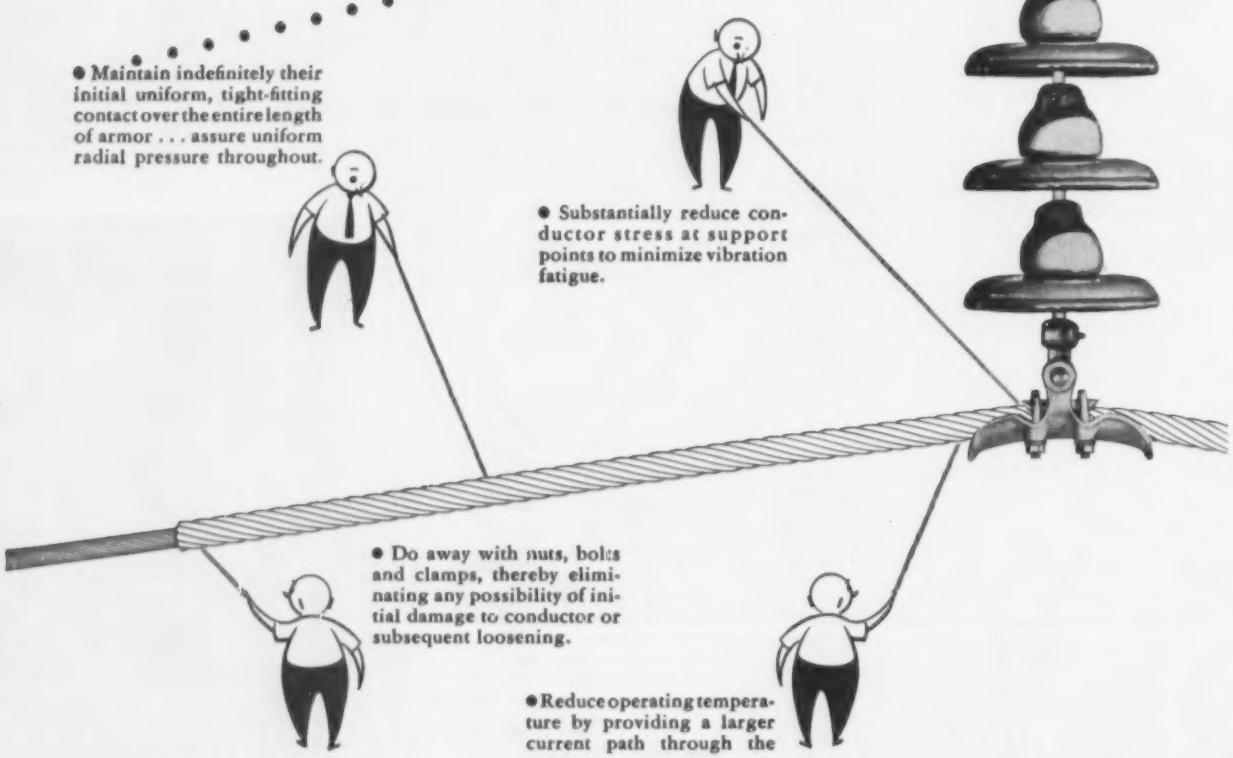
LOOK . . .

PREFORMED ARMOR RODS



• Maintain indefinitely their initial uniform, tight-fitting contact over the entire length of armor . . . assure uniform radial pressure throughout.

• Substantially reduce conductor stress at support points to minimize vibration fatigue.



• Do away with nuts, bolts and clamps, thereby eliminating any possibility of initial damage to conductor or subsequent loosening.

• Reduce operating temperature by providing a larger current path through the support.

**Preformed Armor Rods are manufactured under Patent No's 2,275,019 and 2,587,521 . . . other patents pending.*

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

TELEPHONE: CLEVELAND EXpress 1-3571

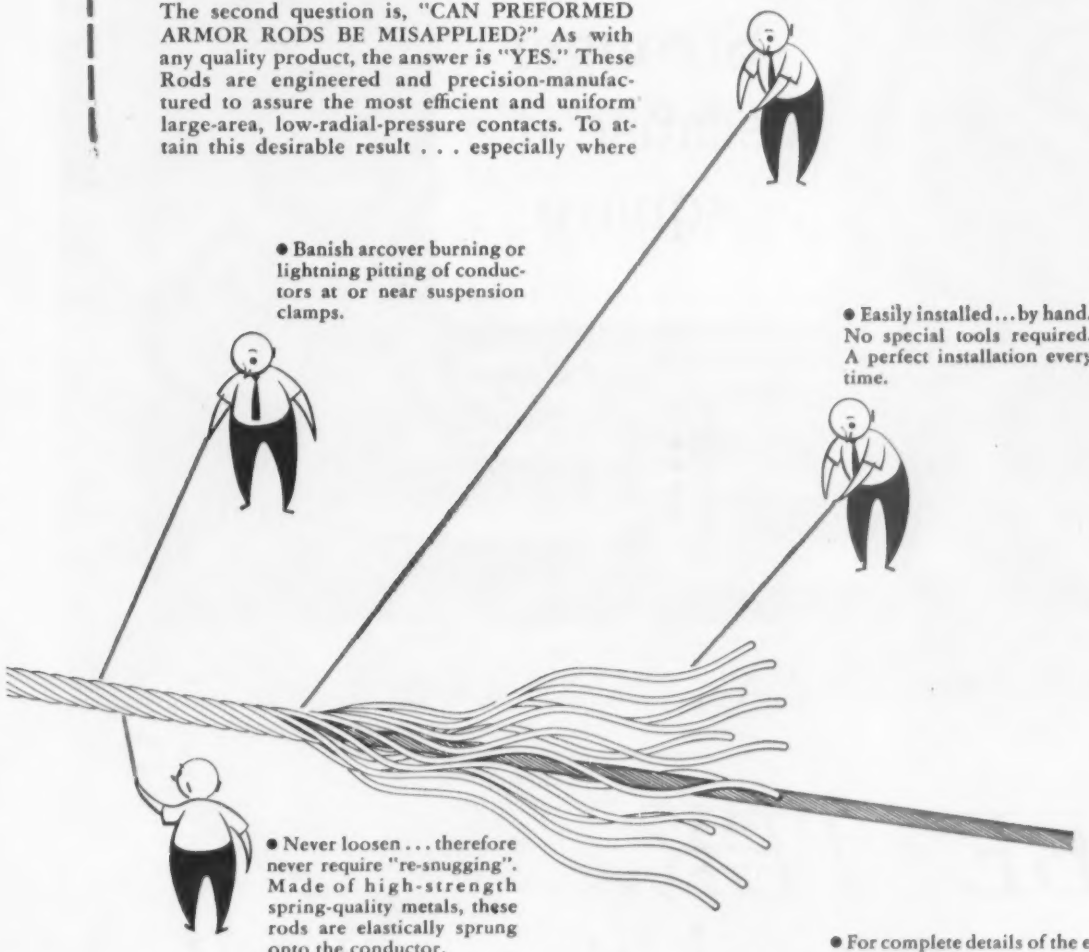
TWO QUESTIONS

Occasionally, we are asked two questions. The first one is, "SHOULD PREFORMED ARMOR RODS BE USED AS DAMPERS?" The answer is "NO." The damping capacity of Armor Rods is slight as compared with properly engineered vibration dampers. Where damping is required, use dampers of the right size, located at the optimum points on the conductor and tuned to the vibration frequency of the conductor.

ARMOR RODS are for reinforcing the conductor and protecting it from damage caused by vibration, concentrated clamp stresses, chafing, arcover, etc. The damping effect of all Armor Rods is negligible. They reduce loading and bending stresses, thereby tremendously increasing the fatigue life of the conductor.

The second question is, "CAN PREFORMED ARMOR RODS BE MISAPPLIED?" As with any quality product, the answer is "YES." These Rods are engineered and precision-manufactured to assure the most efficient and uniform large-area, low-radial-pressure contacts. To attain this desirable result . . . especially where tensions are high, temperatures low and vibration severe . . . each set of Preformed Armor Rods must be applied to the conductor for which it is designed and the rods must not be distorted during application. If rods are reused, make sure they are removed and reapplied with care and that their dimensions are checked closely.

Applied correctly, Preformed Armor Rods assure the longest satisfactory transmission and distribution line life.



- Prevent wear, chafing or fretting and will not cause radio or television interference.
- Banish arcover burning or lightning pitting of conductors at or near suspension clamps.
- Easily installed...by hand. No special tools required. A perfect installation every time.
- Never loosen . . . therefore never require "re-snugging". Made of high-strength spring-quality metals, these rods are elastically sprung onto the conductor.
- For complete details of the exclusive advantages of Preformed Armor Rods, write or telephone Cleveland: EXpress 1-3571.

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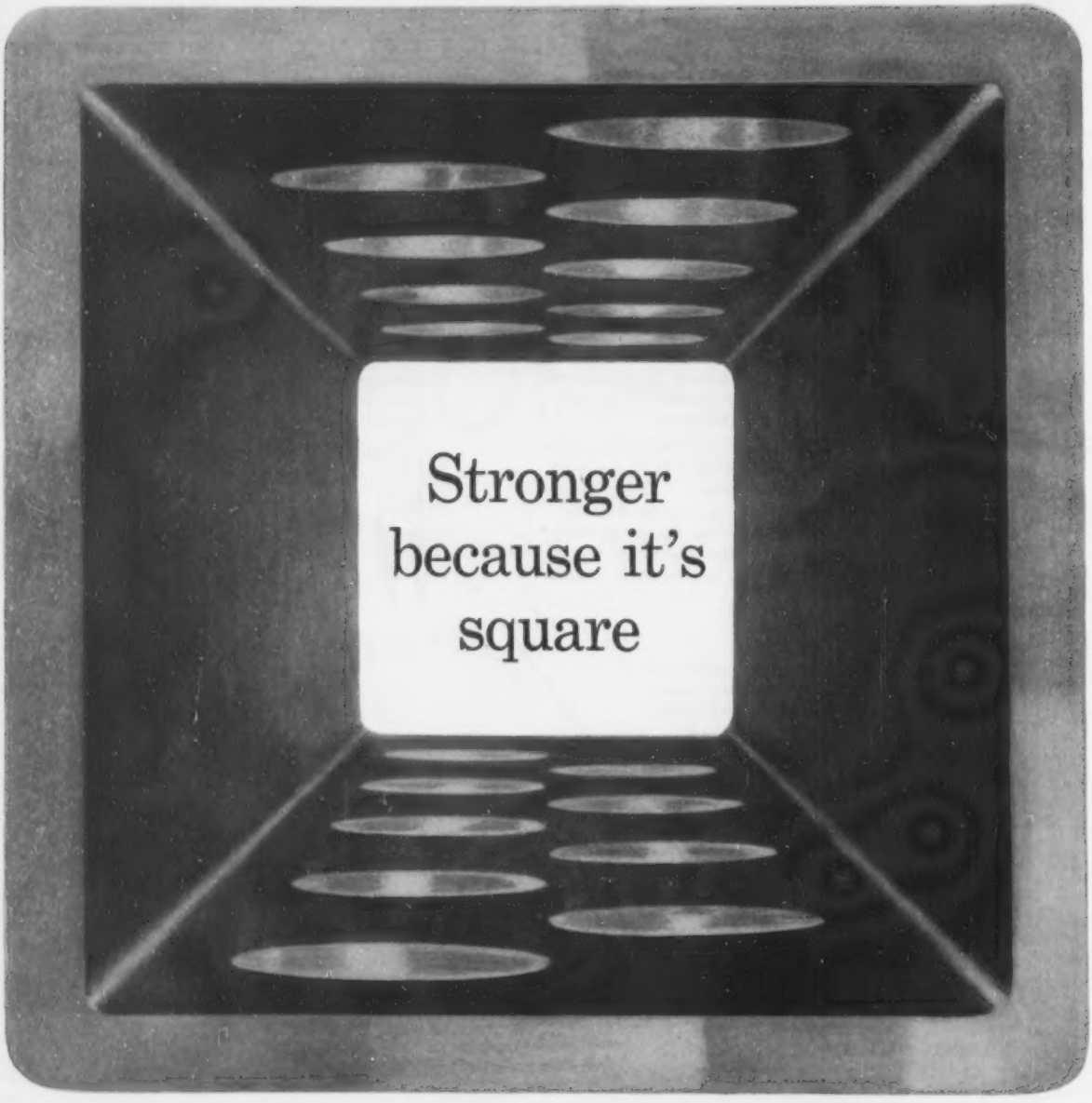

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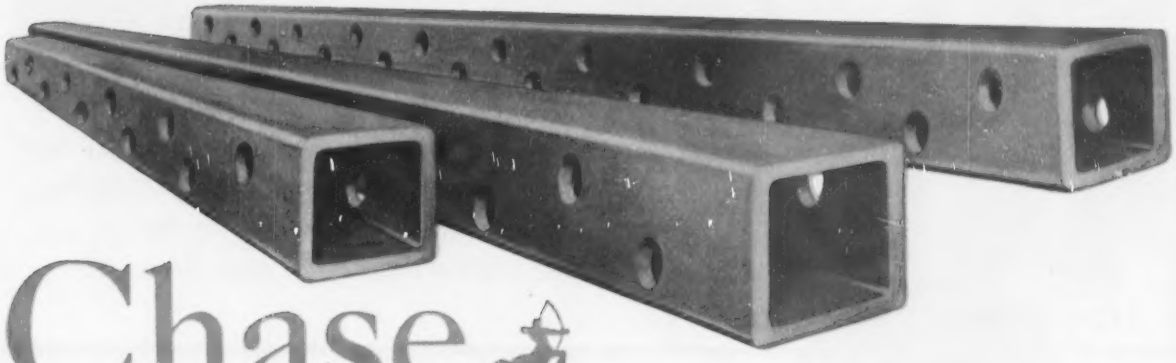

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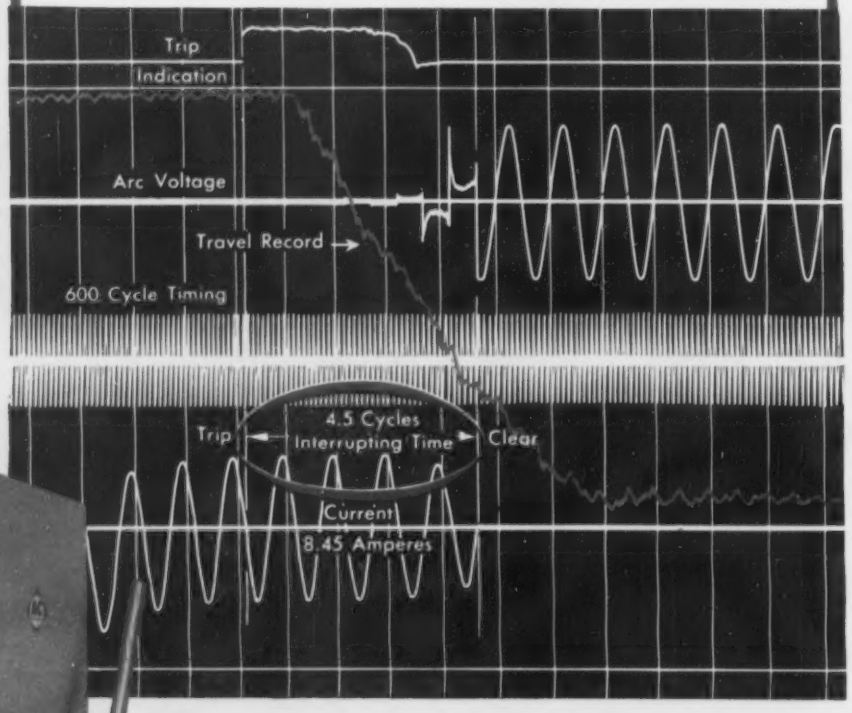
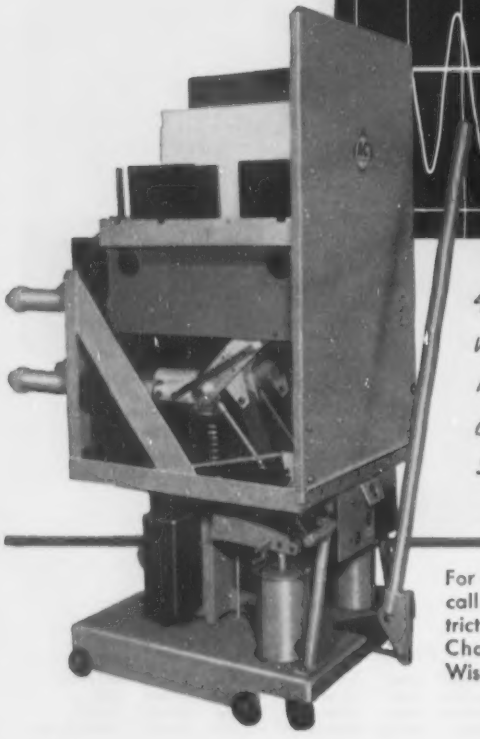
ALLIS-CHALMERS
PROGRESS IN
Switchgear

Here's ON NEW 13.8-kv METAL-

FAST ON LOW CURRENTS





4.5 cycle and 4.1 cycle interruptions shown here are well within 8 cycles allowed by the ASA standards for even heavy currents. Low current switching··· always considered difficult··· now handled easily. Horizontal contact separation plus effective puffer design make this possible.

For additional information, call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4288

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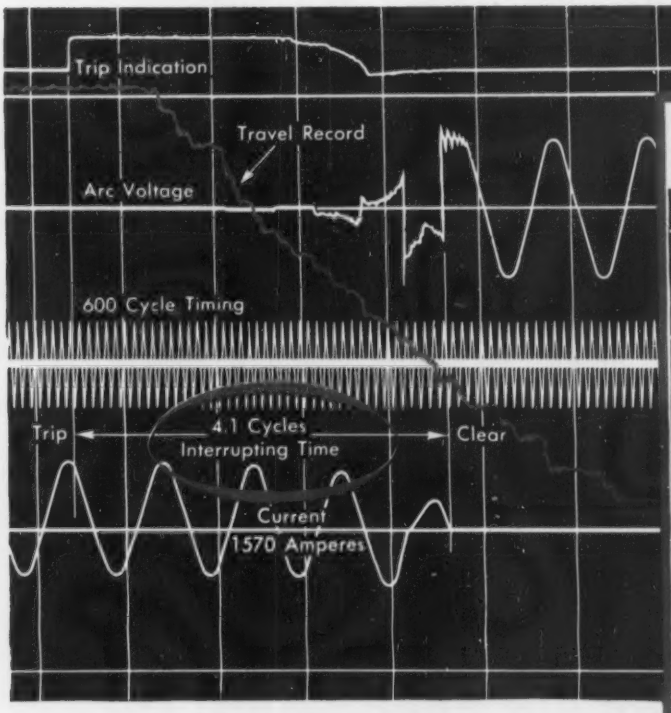
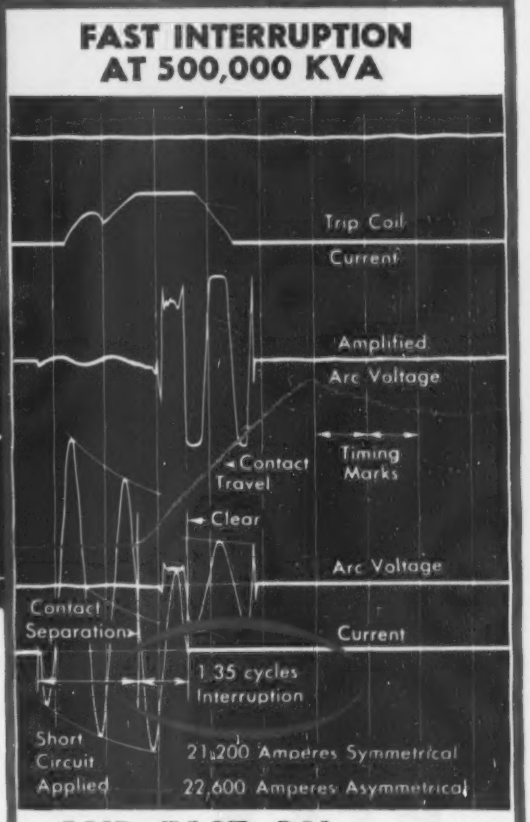
Proof OF FAST INTERRUPTION
BREAKER for CLAD SWITCHGEAR



New breaker also has high speed 4-bar mechanism··· "blow-on" contacts ··· and sectionalized arc chute assembly that can be lifted off by one man.



AND FAST ON HIGH CURRENTS TOO!

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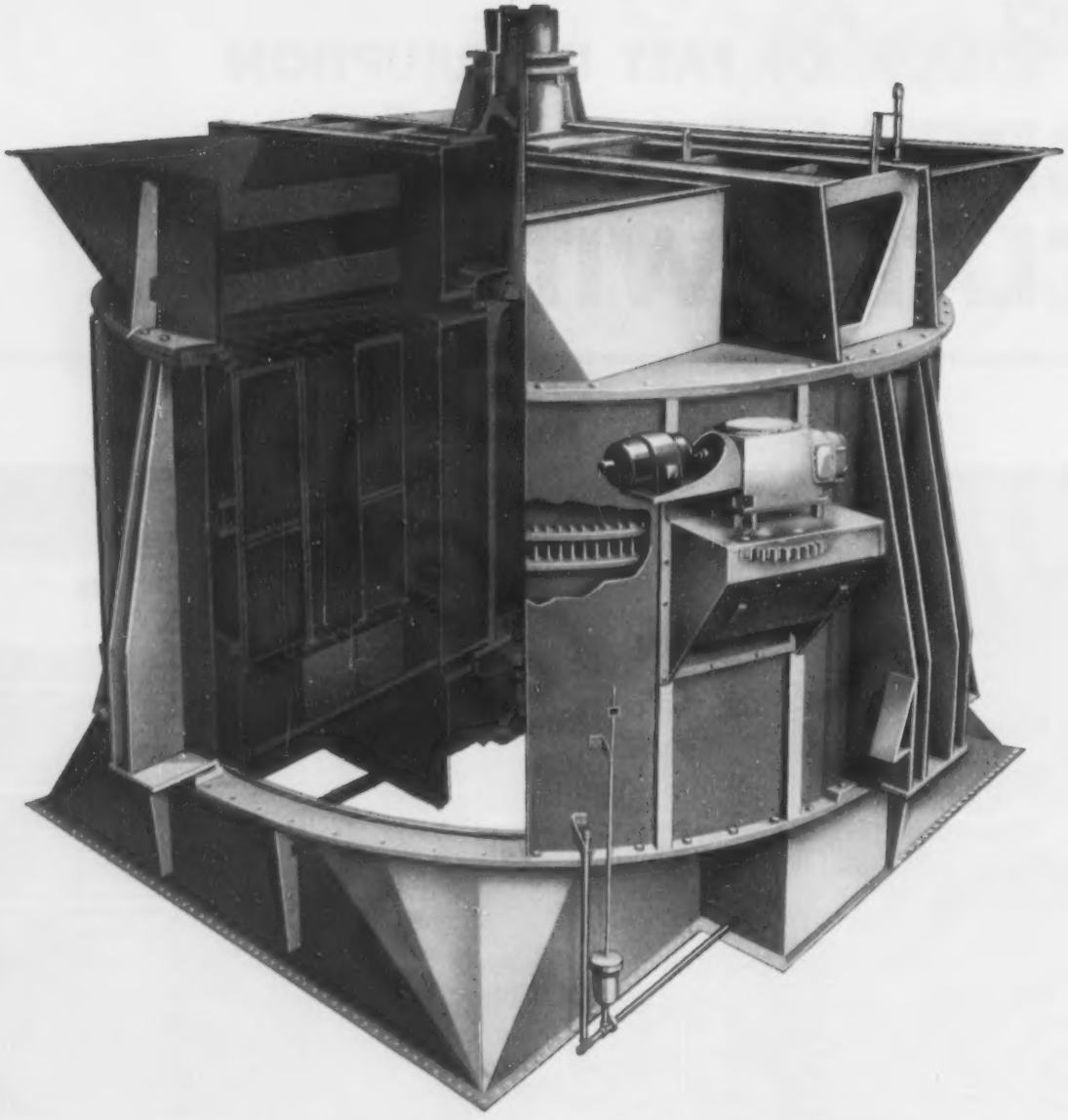

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When subjected to 42 days in ammonium hydroxide and to 150 hours in sulfuric acid, the new G-E White demonstrated excellent corrosion-resistant qualities.
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G-E WHITE
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An extreme test of 42 days in 100% humidity at 105° F indicated G-E White conduit to be very suitable for warm, moist locations.
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Results of 1000 hours in a 20% solution of salt spray at 95° F showed that G-E White conduit is ideal for salt water atmospheres.

Six months of grueling laboratory and field tests show that a G-E White rigid steel conduit installation offers improved corrosion-resistance. This improved protection is a result of the metallizing process used for zinc galvanizing on G-E White. Metallizing bonds a controlled, non-flaking coating of zinc to the entire exterior of the conduit — threads and all. The inside is protected, too, by a special organic coating that produces a smooth, stable surface. G-E White conduit is listed by Underwriters' Laboratories, Inc., meets Federal Specification WW-C-581b.

Contractors and maintenance men like the many features, such as easy bending and wire-pulling, that speed installation. For more information write Section C44-527, Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

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1. Corona free at 300 Kv to ground with switch closed and 275 Kv to ground with switch open — with less than 500 micro volts radio influence. Best R. I. V. test performance of any switch to date.
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3. Accurate dead center blade control crank driven by Torsional Interphase rods — provides impact-free movement of blade as it comes to fully open or closed positions.
4. Low operating effort thru weather protected counter-balanced mechanism and efficient gear reduction.
5. Sealed Pressure Hinge Contact with well established extra high momentary withstand factor.

IN addition to the many other outstanding design features that characterize

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Compare these Facts

Illustrating ease of operation — only 30 pounds maximum required on 12 inch handle to engage contacts on above switch!

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380 Kv AIR SWITCH

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Ratings

380 Kv., 1470 Kv. Impulse Withstand

1600 Amperes

The switch shown here illustrates the ultimate voltage, open gap coordination with 8-unit insulator stack — assembled for operation test. Many of these switches at 330 kv, 7-unit high, will be supplied for one of the stations on one of the first 330 kv systems in the country.

OVER THE HIGH VOLTAGE HORIZON

The R&IE Research and Development program includes switch design and testing to voltage levels over 400 kv and even to 500 kv. Watch the switch that is ahead. Bring your switch application problems to the —

R&IE SWITCHING EQUIPMENT

DIVISION OF I-T-E CIRCUIT BREAKER CO.,

GREENSBURG, PA.

STRUCTURES—steel or aluminum • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION • OUTDOOR BUS SUPPORTS and AIR SWITCHES • SUBSTATION

As never before...

Today we are all aware of the disastrous and far-reaching effects of a major industrial fire. Owners . . . management . . . employees . . . customers . . . almost every one suffers, in one way or another, when a serious fire strikes.

Could it happen to your plant? Now is the time to take a long, close look at your plant's fire protection measures. Remember, the local fire protection ordinances normally only set minimum standards. Compliance with these ordinances is no guarantee of fully adequate firesafety.

One way to be absolutely sure of the efficiency of your plant's fire protection facilities is to call in an expert C-O-TWO Fire Protection Engineer. He is ready and willing to help you with any or all industrial fire hazard problems.

There is a personal sense of responsibility inherent with C-O-TWO Fire Protection Engineers that assures you of fully adequate firesafety . . . a definite plus in your behalf. Whether it's fire detecting or fire extinguishing . . . portables or built-in systems . . . C-O-TWO means top quality backed by experienced engineering that results in operating superiority for you at all times.

WHEN BUSINESS STOPS . . . INCOME STOPS!

Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today . . . our extensive experience over the years is at your disposal without obligation. Get the facts now!

C-O-TWO

MANUFACTURERS OF APPROVED FIRE PROTECTION EQUIPMENT

Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
Built-In Smoke and Heat Fire Detecting Systems

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Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

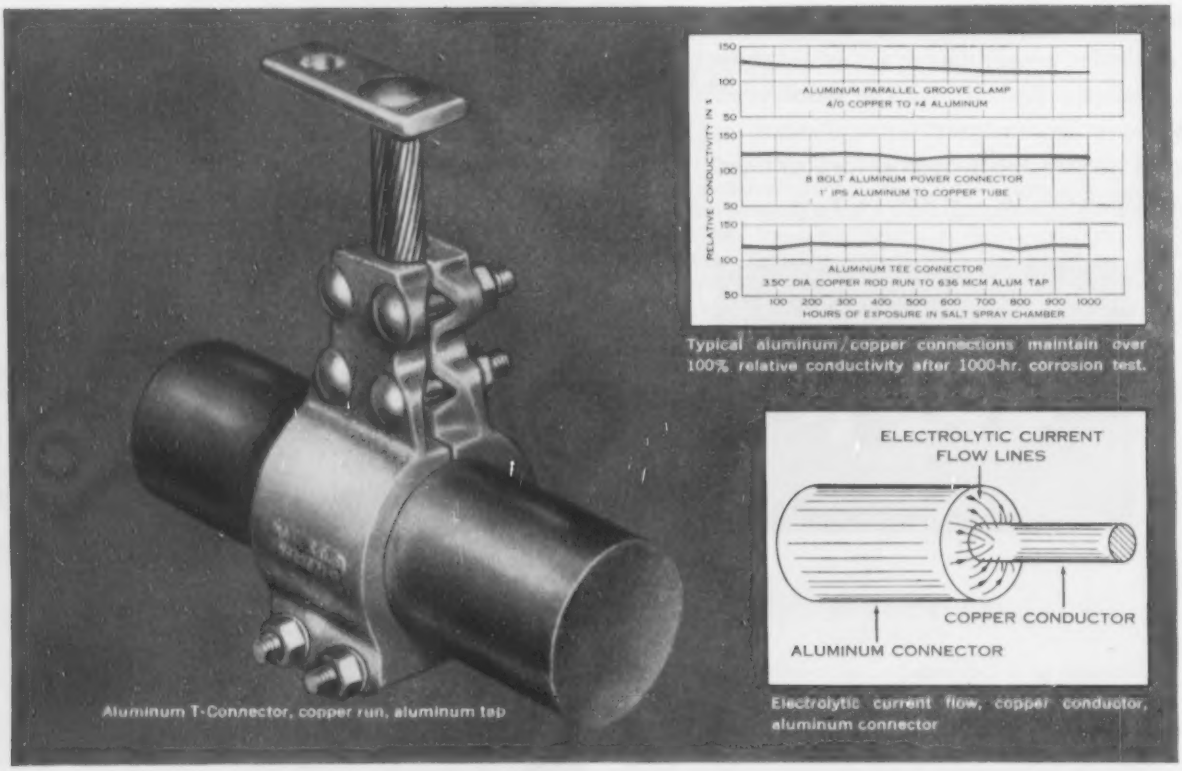
IT'S THE PORCELAIN
THAT INSULATES

...AND LAPP PORCELAIN IS YOUR GUARANTEE OF SUSPENSION INSULATOR QUALITY

Lapp is the maker of porcelain insulators and insulating components which provide *an extra margin of operating security . . . long life . . . low upkeep and maintenance.* And nowhere is the importance of "Lapp quality" porcelain (and Lapp assembly) greater than in suspension units for transmission line duty . . . The specification *"Lapp Suspension Insulators"* is low premium insurance of long trouble-free service for your lines. Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

new connector design principle ends galvanic corrosion problem


ALUMINUM PARALLEL GROOVE CLAMP
4/0 COPPER TO #4 ALUMINUM
8 BOLT ALUMINUM POWER CONNECTOR
1" IPS ALUMINUM TO COPPER TUBE
ALUMINUM TEE CONNECTOR
.350" DIA. COPPER ROD RUN TO 636 MCM ALUM. TAP
RELATIVE CONDUCTIVITY IN %
150
100
50
100 200 300 400 500 600 700 800 900 1000
HOURS OF EXPOSURE IN SALT SPRAY CHAMBER
ELECTROLYTIC CURRENT FLOW LINES
COPPER CONDUCTOR
ALUMINUM CONNECTOR

Aluminum T-Connector, copper run, aluminum tap

Typical aluminum/copper connections maintain over 100% relative conductivity after 1000-hr. corrosion test.

Electrolytic current flow, copper conductor, aluminum connector

Lasting Aluminum/Copper Joints Made with Newly-Developed "Proportioned" Aluminum Connectors

Embodying a new design principle for electrical connectors, "proportioned" aluminum connectors developed by Burndy prevent joint deterioration resulting from galvanic corrosion in aluminum/copper connections – and also provide a sturdy, dependable connection in the more common application of aluminum-to-aluminum. Extensive test data support the new principle that properly designed and proportioned aluminum connectors – clamp- or compression-type – work successfully with any size or combination of copper and/or aluminum conductors.

Proportioned Connectors Control Electrolytic Current Density

The principle behind the successful performance of Burndy's new aluminum connectors is based on an analysis of the mechanism of electrolytic action:

1. *In a copper/aluminum connection aluminum is anodic and copper cathodic in the electrolytic series. Hence in a cell formed by the presence of an electrolyte, it is the aluminum that is attacked.*

2. *The rate of galvanic corrosion is directly related to the density of electrolytic current on the exposed surface of the aluminum.*

3. *When aluminum connectors are properly proportioned–designed with sufficient mass relative to that of the copper conductor – the electrolytic current is distributed thinly over the relatively large surface of the aluminum connector body. As a result of this low current density, erosion of the connector is negligible, and isolated to an area where it does not affect the efficiency of the connection. (As with other connections involving aluminum, scratch-brushing and use of Penetrox A is desirable to penetrate the oxide film and aid in sealing the joint.)*

In this way an aluminum connector, properly designed, can offer a long, efficient service life for any combination of copper/aluminum joints under the most severely corrosive atmospheres. *No plating, bushing, or liners are necessary, as long as the aluminum connector is correctly proportioned.*

Mechanical As Well As Electrical Factors Considered

Burndy's proportioned design allows for the greater thermal coefficient of expansion of aluminum as compared to copper. With the proper mass, the aluminum connector will run cooler than the copper conductor, thus compensating for the expansion differential. Another advantage of the design, of course, is the control of cold flow by providing more contact area for a wider distribution of clamping force. The aluminum alloy used by Burndy is completely free of copper, thus eliminating the dangers of stress corrosion. A factory coating of protective compound, immediately following oxide removal, protects the surfaces of the aluminum connectors and reduces the problem of aluminum oxide to a minimum. Hardware is anodized aluminum for maximum corrosion resistance.

Rigorous Testing Program Proves Reliability of Design

To establish the significance of the general principles, as well as the efficiency of specific designs, extensive tests were conducted involving a wide range of sizes and types of connectors and conductors. These tests included a series of 50 heat cycles with overload currents more than twice the rated load of the conductor—sufficient to produce a temperature of 100°C in the connector. Accelerated corrosion tests were run for 1,000 hours in a standard salt spray chamber. As shown on the charts, joint resistance, electrical conductivity and temperature all remained stable after these severe tests.

These new proportioned aluminum connectors are available as a broad general line, paralleling Burndy's comprehensive line of copper connectors. Catalogs which include considerable technical data and information have been prepared to help you select the most appropriate connectors for your specific requirements:

For substation and power connectors—Catalog AL55. Other catalogs on connections for aluminum:

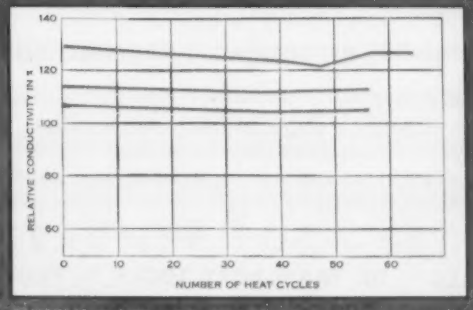
For overhead lines—Catalog AL53

For building wire—Catalog AL54

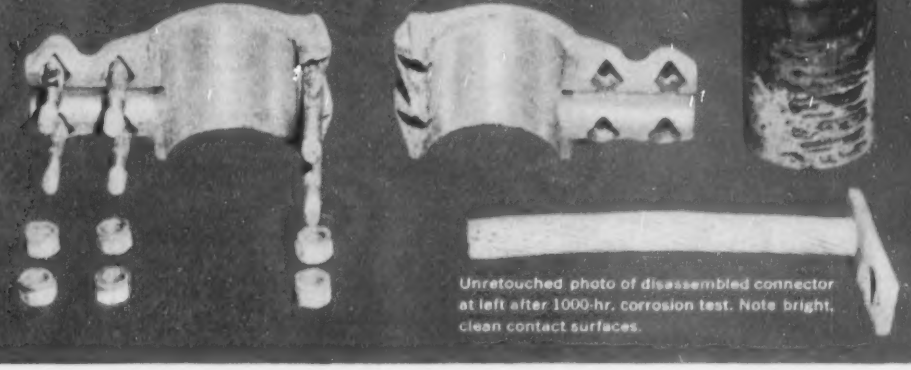
BURNDY

NORWALK, CONNECT. • TORONTO, CANADA
FACTORIES: NEW YORK, CALIFORNIA, TORONTO
EXPORT: PHILIPS EXPORT COMPANY

54-14



Electrical stability of typical aluminum/copper connections demonstrated by heat cycling



Unretouched photo of disassembled connector at left after 1000-hr. corrosion test. Note bright, clean contact surfaces.

HOW TO MAKE YOUR TOOLS LAST LONGER

JAMES R. KEARNEY
The Mark of Quality Products

TO PROTECT your linemen . . . protect your tools. A good Hi-Line Safety Record doesn't just happen . . . it starts with good workmen using good equipment. When you buy Kearney Hi-Line Tools you buy the best. Make sure they stay that way by following this commonsense guide to longer service life.

1. BE SURE TO BUY TOOLS ENGINEERED and BUILT TO DO THE JOB BETTER

2. STORE TOOLS IN A HOT ROOM

When you receive the tools, store them in a room where the temperature remains between 90 and 100° F.

3. WRAP TOOLS IN CANVAS

On the job . . . on the truck, avoid surface abrasion by placing tools in separate canvas bags or rolling them in individual pieces of canvas.

4. STACK TOOLS VERTICALLY

A vertical position in racks built above the floor line permits faster dispersion of moisture.

5. AVOID CONTACT WITH MASONRY WALLS

Masonry walls of any type breathe moisture. Keep tools at least 2 feet from concrete, plaster, brick, etc.

6. NEVER LAY TOOLS ON GROUND

Surface moisture accumulates quickly if a tool is laid on the ground. Instead, avoid moisture and abrasion by placing on a canvas blanket.

7. REMOVE OIL AND PERSPIRATION

Tools should be wiped frequently with a dry rag whenever oil or perspiration is detected on the surface.

8. INSPECT TOOLS PERIODICALLY

Give your tools the "eagle eye" at regular intervals. Inspect them as you would a fine firearm. Make small repairs promptly. Replace damaged tools before they fail you.

9. REFINISHING VARNISHED POLES

Be sure to use Kearney Wood Pre-Ser-Vor, a 100% pure phenolic varnish which assures maximum dielectric value. Full directions for use are on the can.

10. TRANSPORT TOOLS IN PROPERLY BUILT TRAILER

Make certain the trailer has individual racks and troughs with all contact surfaces rubber or felt padded. Trailer should also have built in electric heater to maintain proper temperature. (These are just two of the features found in Kearney trailers.)

Write today for your free copy of the 72-page, pocket size Kearney Manual on hot line work. It includes 20 fully illustrated job descriptions designed to save your crews time and trouble.

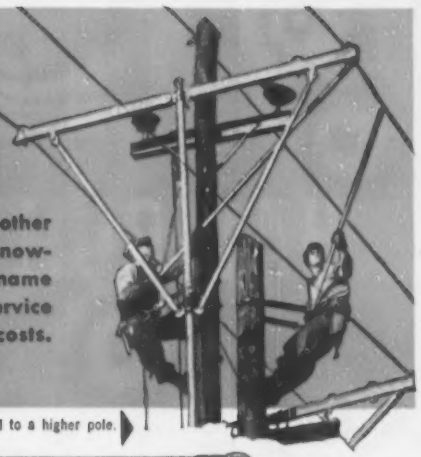
Specify KEARNEY

JAMES R. KEARNEY CORPORATION • Office and Factory

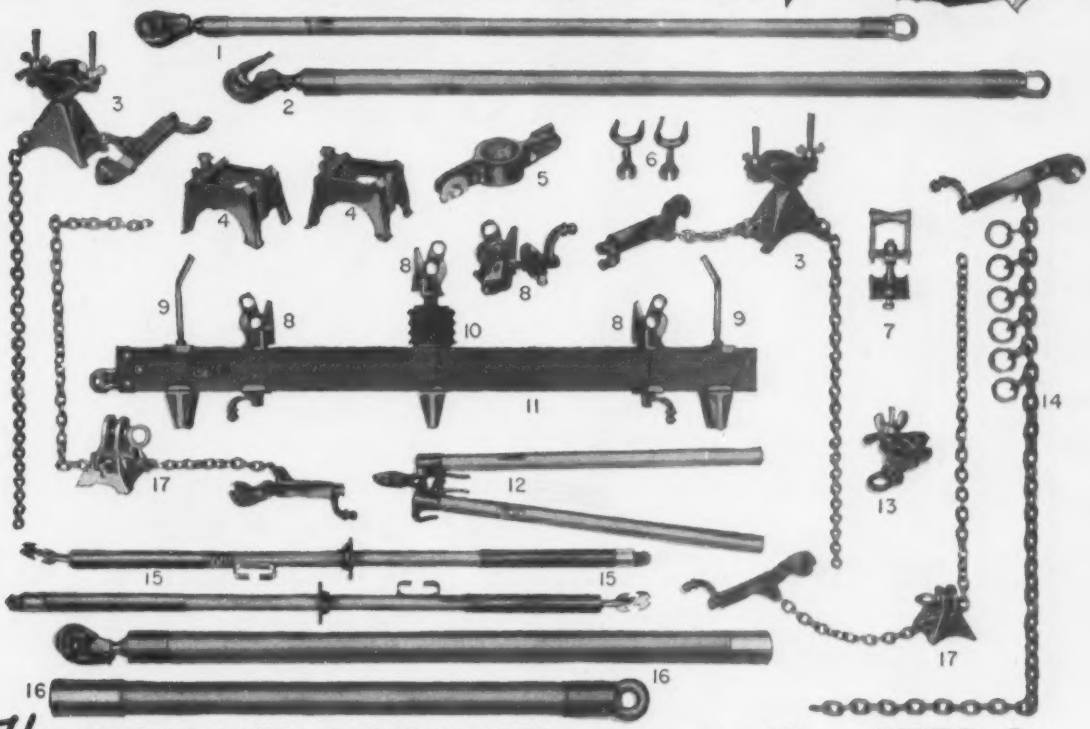
This Time Get The Best . . . For SERVICE, SAFETY and ECONOMY . . . *Specify*

KEARNEY Hi-LINE TOOLS

There's at least one important difference between Kearney and other tool manufacturers . . . and that's length of experience. Years of "know-how" stand behind every piece of equipment that carries the name "Kearney Hi-Line Tool." This "know-how" can improve your service continuity, better your safety record, and lower your operating costs. Put it to work for you. Mark that next tool order "Kearney."



The Kearney Lifting Tool supports conductors as phases are shifted to a higher pole.



The KEARNEY TOOL SET CATALOG No. 4778-3

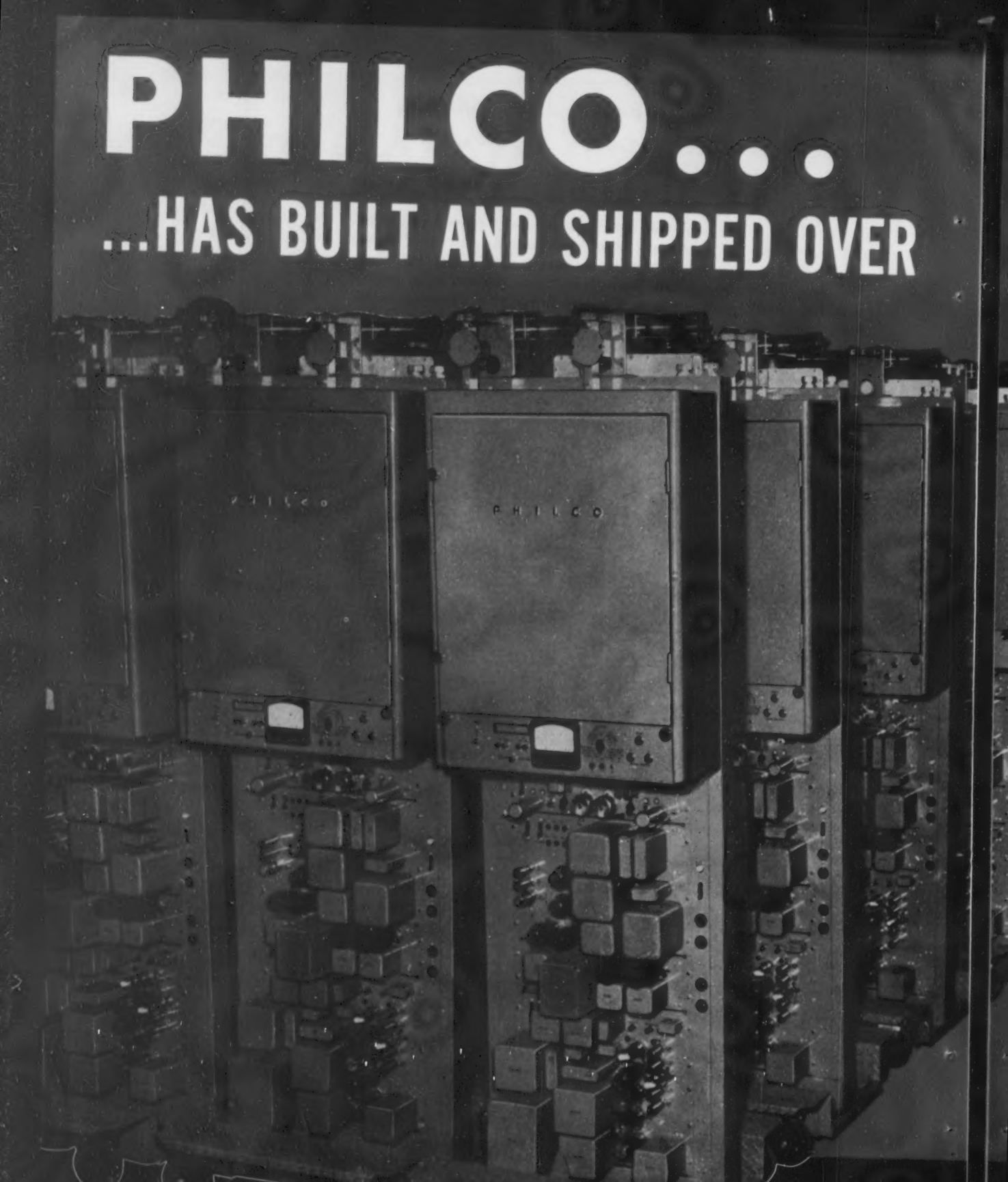
COMPLETE SET INCLUDES:

1. No. 4655-6 Hand Pole 1½" x 10'
2. No. 4656-1 Lift Pole 2" x 10'
3. No. 4760-5 Pole Grip
4. No. 4760-7 Pole Grip Extensions
5. No. 4760-26 Brace Bracket
6. No. 4455-17 Tie Wire Heads
7. No. 4800-4 Side Arm Attachment
8. No. 4800-31 Conductor Holders
9. No. 4800-33 Line Guard Assembly
10. No. 4800-32 Insulator Conductor Holder
11. No. 4800-6 Side Arm only, 9'
12. No. 4773-1 Insulated Pliers 1¼" x 5'
13. No. 4625 Hand Pole Snub
14. No. 1846 Rope Hitch
15. No. 1855-4 Combination Tie Sticks 1¼" x 8'
16. No. 4657-3 Lift Pole 2½" x 16' spliced
17. No. 7481 Lift Pole Snubs

253-

Products *for Better Construction . . . Safer Maintenance*

4224-42 CLAYTON AVE., ST. LOUIS, MO. • Canadian Plant: GUELPH, ONTARIO


PHILCO...
...HAS BUILT AND SHIPPED OVER
PHILCO

1000 MICROWAVE EQUIPMENTS

More than ALL OTHER Manufacturers Combined!

As the world's leading supplier of microwave, Philco has manufactured and delivered nearly 1400 complete microwave equipments...enough to span the nation five times—*or to privately link New York and Hong Kong!* Philco has built and shipped more microwave systems than all other manufacturers combined.

Philco has the distinct advantage of a world-wide installation and service organization, and an experienced system-planning department. These valuable facilities enable Philco to obtain first-hand information on the operation of existing installations, improve equipment, and thus supply new microwave systems which assure the greatest economy and dependability in performance.

This is one reason why Philco microwave is the preference of industry—*good reason why Philco is the world's leading manufacturer of microwave equipment.*

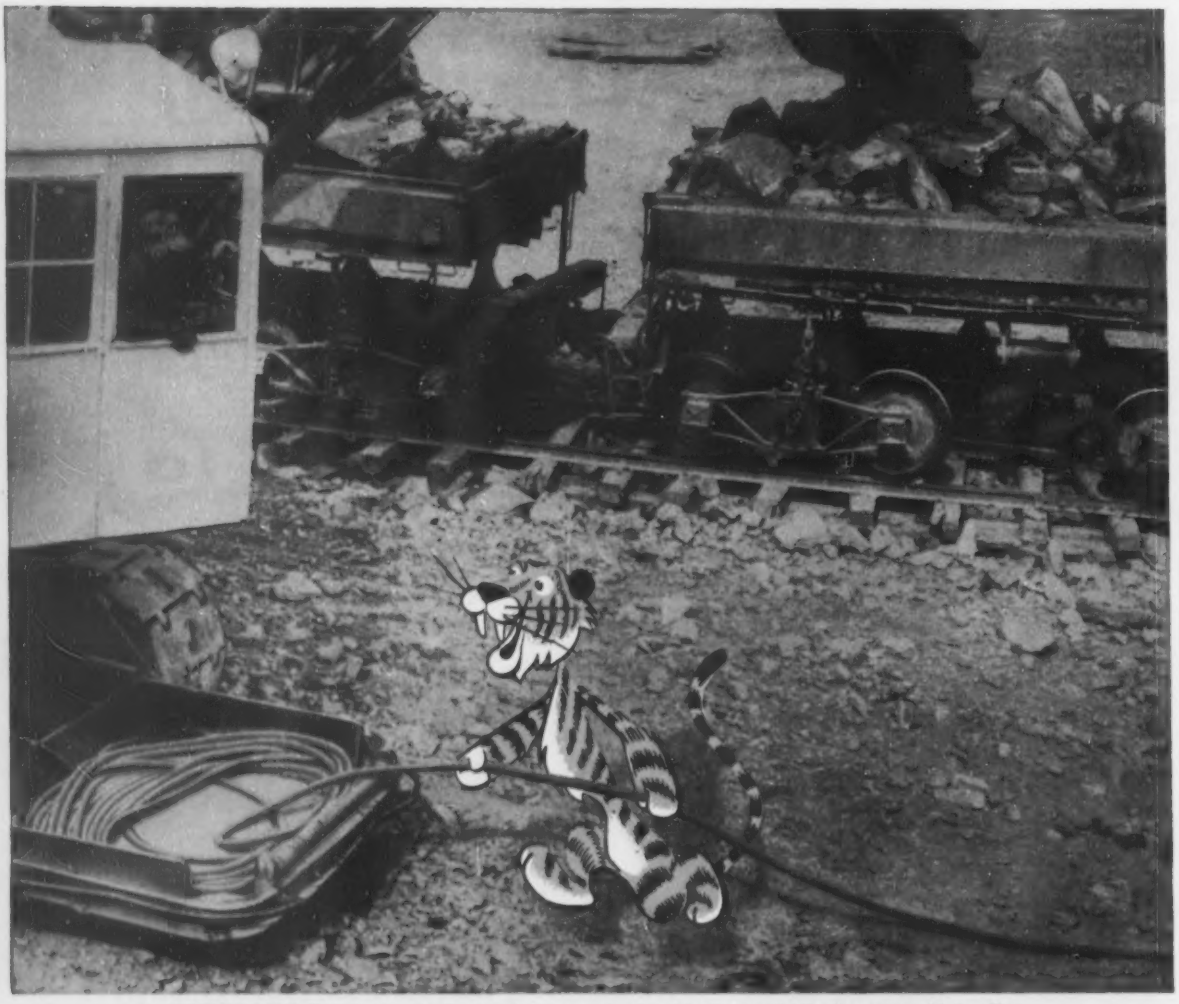
Need a speedy and permanent cure for those communication headaches? Then consider microwave . . . and when you do, specify Philco. An experienced Philco representative is ready to serve you.

World's Leading Manufacturer of Microwave Equipment!

For complete details, write to Dept. PW today

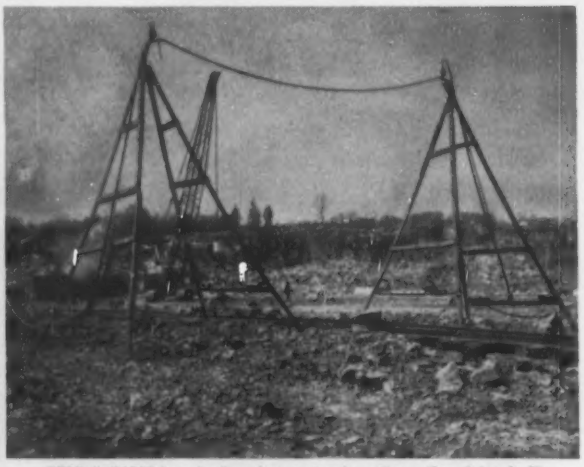
PHILCO
QUALITY

"Our *Tiger Brand*



NOTICE THE CABLE TRAY fastened to the shovel. This was developed by Universal Atlas for easier cable handling.

TWO WORKMAN WATCH from blast shelter as charge is set off in distance. Low horses cushion cable from shock of falling rock.



HERE A CABLE is raised on horses to clear the railroad track. It feeds the shovel visible in background.

PHILCO CORPORATION

GOVERNMENT & INDUSTRIAL DIVISION PHILADELPHIA 44, PA.

Amerclad lasted 12 years"

Says Chief Electrician, Hudson Plant
Universal Atlas Cement Company

Year after year, at this quarry, the Amerclad is exposed to knife-sharp fragments of flying rock. During the summer, the rock often gets so hot that you can't even touch it. Other times, the cable lies out in the rain and snow—often at sub-zero temperatures.

At the Hudson, N. Y. quarry of Universal Atlas, Chief Electrician Frank Rodmond said, "This Amerclad runs the constant danger of being hit with flying rock fragments through secondary blasting. Yet the down-time cost of this operation is so high that we just can't stand cables that keep failing. We kept that last batch of Amerclad 12 years before we replaced it, yet it was still serviceable when we switched over to new Amerclad."

If you want service like this, specify Amerclad the next time you need cable that can really take it. Amerclad is available in a great many sizes and constructions, with or without shielding. There is a type to power anything from a river dredge or mine locomotive down to a rough and tumble electric hand drill. *Send the coupon,* and get more information.

AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
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THIS IS A TYPICAL DRILL. It uses a 4-conductor No. 8 Amerclad cable.

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB!

paper & varnished cambric cable
asbestos wire and cable
aerial, underground & submarine cable
mold cured portable cord
machine tool & building wire
special purpose wire & cable
shovel & dredge cable

—SEND THE COUPON—

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Room EE-54, Rockefeller Building
Cleveland 13, Ohio

☐ Please give me more information about Amerclad.
☐ I'd like to talk to your representative.

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Address .....
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U·S·S Tiger Brand ELECTRICAL WIRE & CABLE

USS

UNITED STATES STEEL

Which Regulator is best?

ORIGINATORS OF 5/8% STEP REGULATION

this Utility compared them

ALLIS-CHALMERS

5/8% STEP VOLTAGE REGULATORS

A large eastern utility untanked and examined all three of the leading makes of voltage regulators. They called in engineers, purchasing people, operating and maintenance men . . . everybody who works on or with regulators. Designs were analyzed, construction checked, operation observed. Result: Allis-Chalmers distribution regulators came out on top.

After a comparison like this, no wonder this utility standardized on Allis-Chalmers distribution regulators. In fact, after more than 20 years of 5/8% step regulator experience, it's no wonder that Allis-Chalmers distribution regulators can meet every test both in the field and in the laboratory.

Now . . . you make the comparison!

You can examine an Allis-Chalmers distribution regulator completely free of charge. Allis-Chalmers will ship any recognized distribution system a Type JFR distribution regulator for thirty days of testing. Get complete information — or a test regulator — by calling your nearest A-C office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin. Allis-Chalmers will also send you a copy of the new "regulator check list" to help you analyze all regulators.

Check these Advantages

***Quick-Break* Mechanism:** fast, efficient tap changing. Long wear made possible by "tool engineer's quality" and precision construction methods. Laboratory tests have proved this mechanism can withstand 5 million operations.

Long-Life Contacts: Large size, made of arc-resisting materials. Will they stand up? Utilities report over 10 years' operation with *no appreciable signs of wear.*

***Feather-Touch* Control:** You get a ± 1 volt band, Class I accuracy. Floating beam of regulating relay means friction can never upset accuracy because no mechanical bearings are needed.

Unit Construction: Simplifies inspection. You can untank a unit simply by disconnecting the position indicator and removing a few cover bolts. Then hoist up on the cover-lifting eyes — complete unit comes up into plain view.

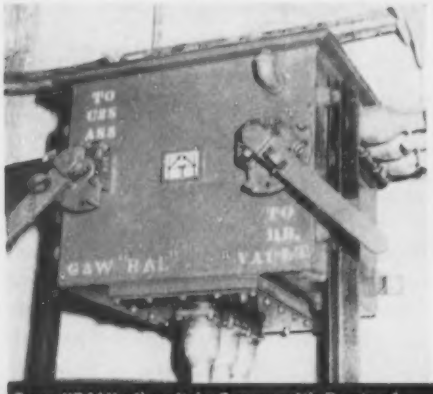
A-4357

ALLIS-CHALMERS

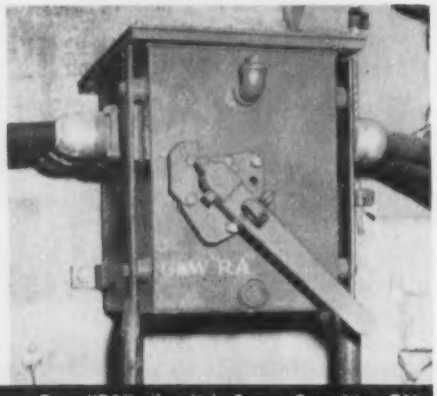
A-C ALLIS-CHALMERS

G&W *load break* secondary
OIL SWITCHES

- **Eliminate Secondary Outages While Changing Transformers**
- **Quickly Restore Secondary Services When Primary Circuit Is Out**

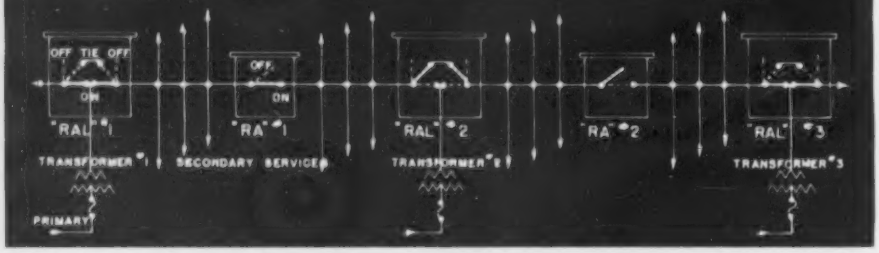


Type "RAL" oil switch, 3-way with 2 sets of links—each 3 position ON-TIE-OFF, 3 pole, 600 volts, 1000 amperes.*



Type "RA" oil switch, 2-way 2 position ON-OFF, 3 pole, 600 volts, 1000 amperes.*

Regularly Used by Electric Utilities for over 25 Years!



Referring to the circuit diagram, the "RA" 2-way oil switches are normally open and the separate groups of secondary services are fed through the "RAL" 3-way oil switches. Assuming that transformer #2 requires "changing out" to a larger size, the secondary loads normally fed from transformer #2 can be transferred to transformer #1 by operating the "RAL" #2 and closing the "RA" #1 load break oil switches.

*Illustrations show wiping sleeves for lead covered cables, but alternate stuffing boxes or porcelain stud bushings for non-leaded cables are available.

Send for Bulletin DB51—Special Section, listing 600 volt "RAL" and "RA" oil switches in 400 ampere and 1000 ampere ratings.

G&W ELECTRIC SPECIALTY CO.
7780 Dante Avenue, Chicago 19, Illinois
Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices, Ltd., Toronto, Montreal & Vancouver.

D542

BIDDLE *Instrument News*

NEW PRODUCTS

New Biddle Dielectric Test Set Model 1-40 KV

—for measuring d-c current at voltages up to 40 kv when applied to the insulation of such equipment as generators, transformers, bushings and cable.

This portable field instrument has been developed in response to the growing use of and demand for higher d-c test voltages.

Carefully considered safety features, excellent output voltage regulation, simple operation, compact design, and facilities for making voltage and current measurements at either polarity have been incorporated in this test set. Years of Biddle engineering experience in insulation testing are reflected in this equipment which has already proven its reliability and performance in field use.

The set has a current rating of 25 milliamperes at short circuit, and current measurements can be made down to 0.5 microamperes which is the first division on the microammeter.

Overall dimensions are: height 19½ in., width 13½ in., depth 20 in., weight 120 lbs. All high voltage components are oil immersed.

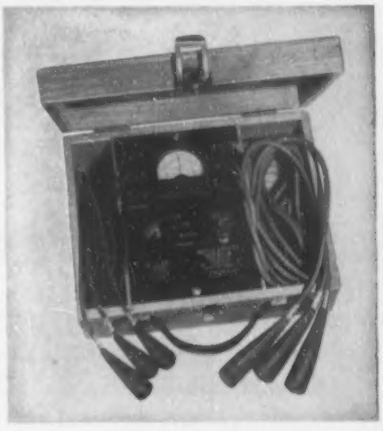
For complete details, description, specifications, and prices, write for **Bulletin 22-W.**

Showing The Biddle Dielectric Test Set, Model 1, on a special hand truck supplied as an accessory for this equipment. This truck permits one man to handle the set safely and without difficulty, on stairways as readily as on the straightaway.

Biddle Motor Rotation and Phase Tester (*Dual Purpose*)

With it you can . . .

- **Determine the direction of rotation of electric motors before they are connected to the line.**
- **Determine the phase rotation or sequence of energized power circuits.**



Here is a positive means for determining which motor leads must be connected to certain conductors of a supply system to insure that the motor will rotate in a prescribed direction when energized.

This device will permit the electrical contractor or industrial maintenance electrician to permanently connect and tape the terminals of the motor being installed, without having to first energize the motor by a temporary "hook-up" from a power source, if available, to determine its rotation.

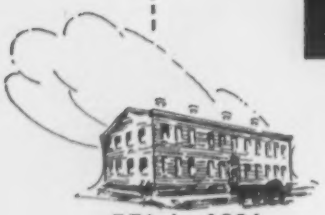
Housed in a sturdy oak case 12¼" x 8¼" x 4¼" this compact unit weighs approximately 10 pounds and is supplied complete with 3 line and 3 motor leads which store in the compartments either side of the instrument panel.

For complete details write for **Bulletin 80-W.**

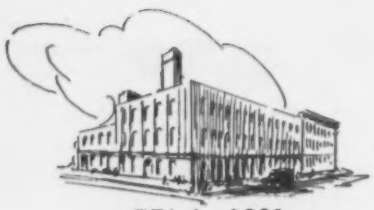
B-415

JAMES G. BIDDLE CO.
1316 ARCH STREET • PHILADELPHIA 7, PA.
ELECTRICAL TESTING INSTRUMENTS • SPEED MEASURING INSTRUMENTS • LABORATORY & SCIENTIFIC EQUIPMENT

ETL



ETL in 1896



ETL in 1921

ETL in 1954

Shedding light on management's problems of production and marketing for 57 years, — providing aid from ETL's electrical, mechanical, chemical, photometric and physical laboratories. This aid is outlined in a booklet sent on request.

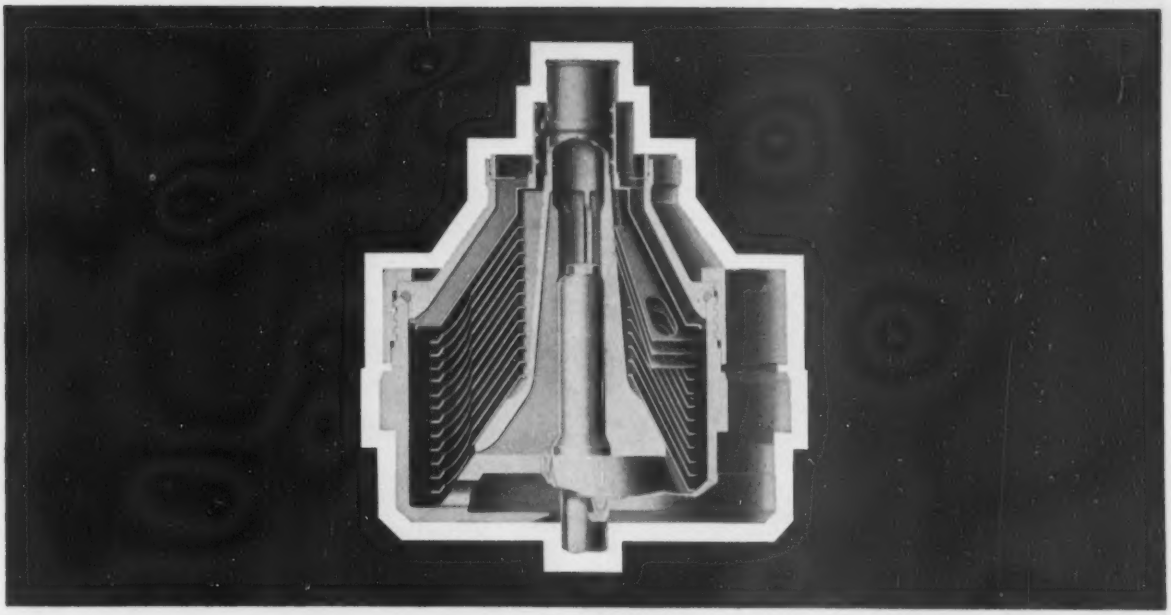
Know ETL *by Test*

ELECTRICAL AND GENERAL TESTING

INSPECTIONS • RESEARCH • CERTIFICATION

ELECTRICAL TESTING LABORATORIES, INC.

2 East End Avenue at 79th Street, New York 21, N. Y.



SAFEST MEANS IN THE WORLD FOR RESTORING DIELECTRIC!

This is a sectional view of a De Laval Insulating Oil Purifier bowl. Wet oil, entering the bowl at the top, rises through the holes in the discs and is promptly dehydrated. Water is thrown to the periphery and continuously discharged to waste. Clean, dry oil rises to the top and is also continuously discharged.

De Laval Insulating Oil Purifiers enable power engineers to be sure that their insulating oil is ***completely*** safe for reuse. Restoral of the dielectric is accomplished in one pass through the centrifuge—at ***low*** temperature. Such low temperature purification has another advantage—it prevents rapid reduction in dielectric strength of the oil after purification.

De Laval Insulating Oil Purification is the ***safest*** means of maintaining oil that there is!

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL

INSULATING OIL PURIFIERS

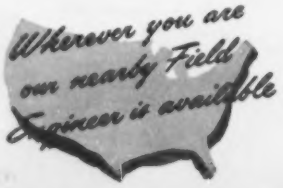
when industrial turbo-generators go bad National gets them back to work **FAST**

When unexpected turbo-generator failure cripples your operations, call National. Your generator will be back on the job in a hurry. Delivery of the rewound unit, or of the necessary rewinding materials, can be made with startling speed because all of the wire and insulating materials used in your windings are fabricated right in the National plant.

National facilities for servicing industrial turbo-generators include large lathes, balancing machines and other tools for mechanical repairs as well as complete equipment for the production of rotor and stator windings. But the big plus value in National service is "know-how". Skilled workmen who know that careful coil installation can make a big difference in the service life of your generator. Engineers who know how to spot and correct the little defects which can bring you big savings in maintenance costs.

National stands for fast service. Yes, but not at the expense of quality. Frequently, in fact, National engineers are able to introduce modifications of design or materials that will make your generator better than ever. "As good as new" is not good enough for National. That's why National rewinding pays for itself so quickly.

No matter what kind of rotating electrical equipment you operate — if it's giving you trouble, call National.



NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

FIRE!

PUT IT OUT IN SECONDS

with a Kidde Portable extinguisher

Unless you get the jump on fire the minute it starts, you stand a good chance of kissing your business good-bye.

That's why it's so important to have a Kidde portable extinguisher near *every* fire hazard in your plant.

Protect motors, electrical equipment, flammable liquids and machinery with Kidde portables. Then, when fire strikes, you're ready for it.

Just grab a Kidde CO_2 or dry chemical portable, aim the horn, pull the trigger, and—Whoosh! No more fire!

Your *next* fire could be your *last* . . . Contact Kidde today!

Kidde (K Kidde)

The words 'Kidde', 'Lux', 'Lux-O-Matic', 'Fyre-Freez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

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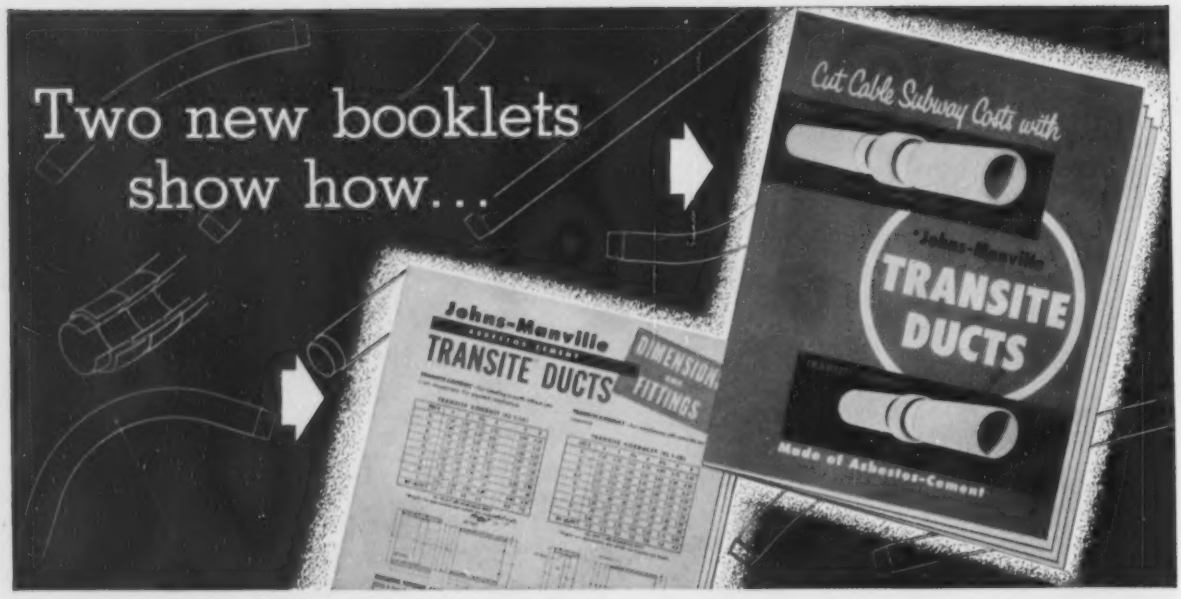


Transite® Ducts cut cable subway costs—

give greater cable protection

Transite Conduit is the thicker walled duct which is used for exposed work or is laid directly in earth without a concrete encasement. Saves time, labor and materials on the job

Transite Korduct® is the thinner walled duct for installation in concrete. Inasmuch as it is used principally for hi-voltage lines, its high thermal conductivity reduces operating losses

● Johns-Manville presents these brochures as a service to public utilities, design engineers, and all other users and planners of cable subway systems. "*Transite Ducts*" shows how improved cable subway protection, installation, maintenance and operational savings may be achieved. "*Transite Ducts, Dimensions and Fittings*" give the necessary dimensional data on all ducts and fittings.

Transite Ducts offer improved cable subway protection. Made of asbestos and cement, Transite cannot burn, smoke, fume or generate explosive gases. Transite confines arc damage and protects adjacent cables against heat and flame. Transite resists corrosive action of soils; is unaffected by electrolysis.

Installation savings result because Transite is strong, light in weight, easy to handle. It comes in long, 10-foot sections, thus, fewer joints are required. Its permanently smooth bore prevents injury to cable either from natural movement or when pulling cable through. Maintenance savings result from the permanent nature of the asbestos cement composition of Transite. It is as durable as stone.

Moreover, operational savings result because cables run cooler due to the high thermal conductivity of Transite Ducts. This also results in prolonged cable insulation life.

For complete details on how Transite Ducts can cut cable subway costs for your system, send for copies of "Transite Ducts," EL-29A and "Dimensions and Fittings," EL-45A. Write to Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto 1, Ontario.

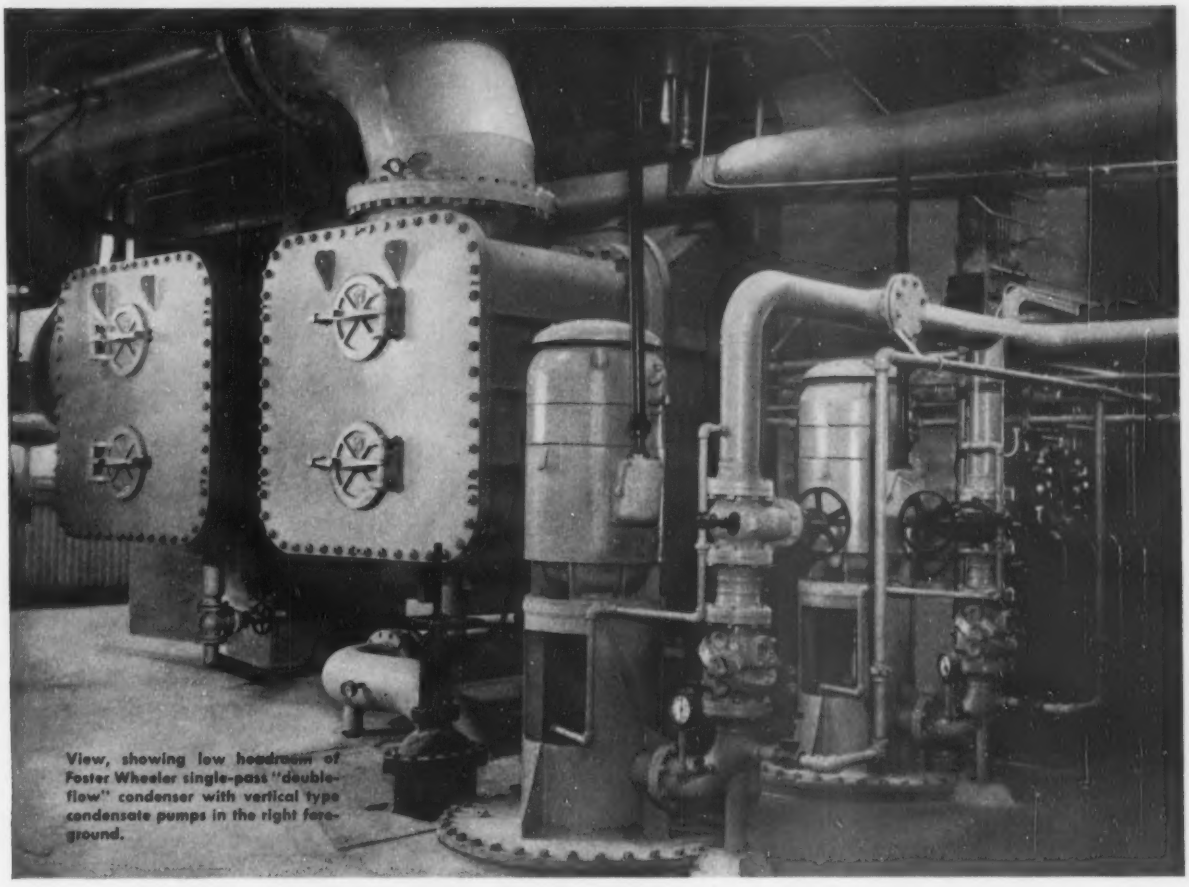
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

SHORTER on headroom - LONGER on savings



View, showing low headroom of Foster Wheeler single-pass "double-flow" condenser with vertical type condensate pumps in the right foreground.

New Foster Wheeler "double-flow" condenser uses 40% less headroom – cuts building costs – more than meets the highest performance standards

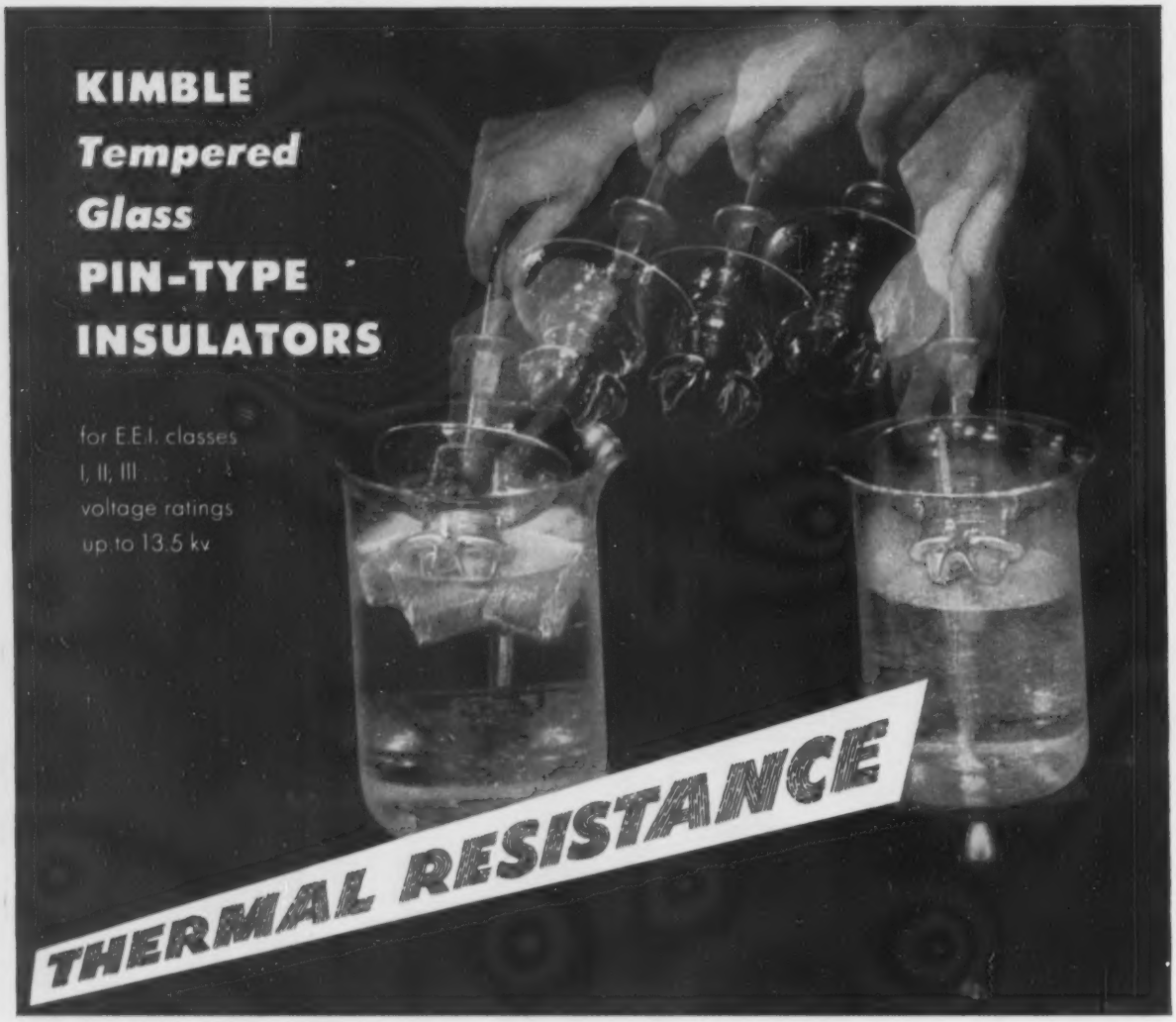
Utilizing a volume only 60% of that customarily required, the new Foster Wheeler "double-flow" principle marks a new advance in condenser design. Less headroom is required—often 40% less than the over-all height of conventional units. This means a proportionately shorter turbine pedestal—and a substantial reduction in building costs.

The rectangular shape makes possible complete utilization of the space available. Intimate contact and scrubbing action between steam and condensate promote effective deaeration and reheating. Condensate leaves the hotwell at steam temperature under all operating conditions. Also, because of the larger steam entrance and shorter tube-bank depth, pressure loss is reduced to a minimum. Efficient cooling of the non-condensate vapors and gases is provided by triangular cooler sections of the series zone type.

In a typical test of a 32,500 sq. ft. unit, the actual heat transfer coefficient showed 578 Btu per hr. per sq. ft. per F as against 510 for commercially clean tubes,—thus resulting in an absolute pressure 0.10 inch better than expected. Further details on request.

FOSTER WHEELER CORPORATION
165 Broadway, New York 6, N. Y.

FOSTER WHEELER



NO CHIPS, CRACKS, OR SPALLS

Laboratory tests to determine the thermal resistance of Kimble *Tempered* Glass Insulators produced no chips, cracks or spalls even after 10 cycles from 40° to 200° F cold-to-hot, hot-to-cold. This high thermal resistance is further demonstrated by their service in the field where they have proved to have unusual resistance to heavy power arcs.

Kimble *Tempered* Glass Insulators save installation time because it's never necessary to loosen up for line-up with the conductor. Their great strength always allows another quarter-turn.

If it's on the pin, it's in service

Tests far in excess of A.I.E.E. standards have proved it impossible to puncture a Kimble *Tempered* Glass Insulator in air. Even lightning surges have failed to damage them. In the event of shattering due to severe mechanical shock, insulator disintegrates into small, non-sharp fragments. Trouble shooters can locate broken insulator—fast.

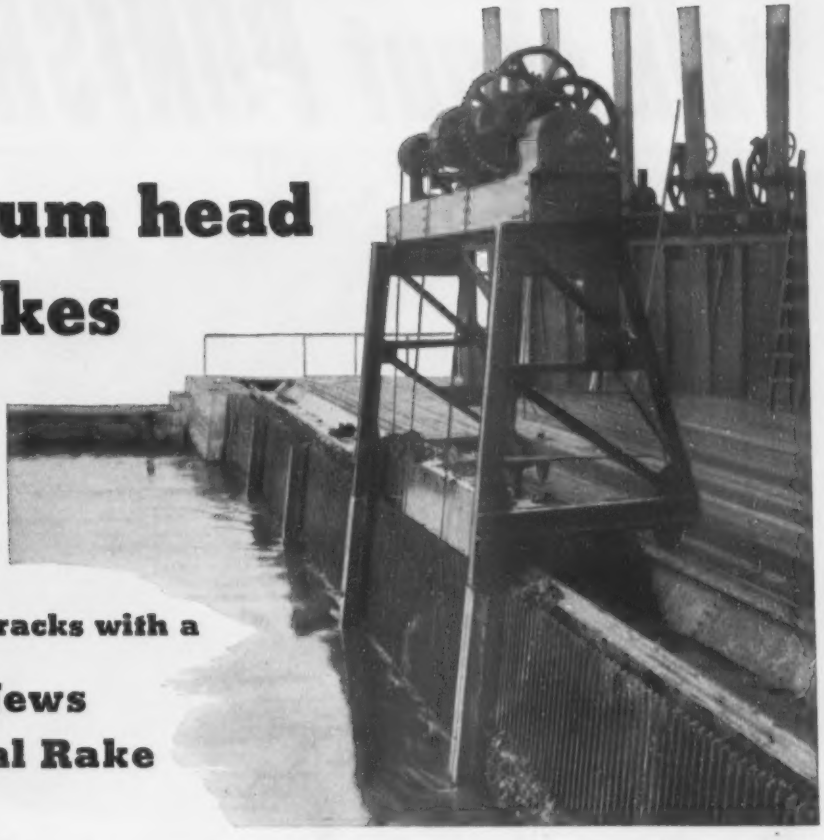
What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how *tempered* glass can cut your line maintenance costs. Write for the new descriptive folder that gives complete details. Address: Kimble Insulator Division, Owens-Illinois, Department EW-5, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

Gain maximum head at Intakes



...by cleaning your racks with a

Newport News Mechanical Rake

Keeping racks clean is essential wherever a few inches of head loss can reduce output of the wheels.

One company calculated the capitalized value of each inch of head gained at its plant as $6,000. Measured in terms of the value of additional power output, a Newport News rack rake installed at this plant is paying for itself over and over again the year 'round.

Power-operated to clean trash racks at water intakes of hydroelectric plants, steam plants, pumping stations, canals and similar installations, the Newport News Mechanical Rack Rake reduces a major hand-labor task to one of minor periodic activity.

Under ordinary conditions, one man per shift can, with a Newport News Mechanical Rack Rake, keep the racks clean for a dozen bays.

Write for your copy of "RACK RAKE," an illustrated booklet describing the operation and advantages of the Newport News Mechanical Rack Rake. Use the convenient coupon now.

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Newport News, Virginia

Newport News Shipbuilding and Dry Dock Company
Dept. EW-5-17, Newport News, Virginia
Please send me a copy of "RACK RAKE."

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City_____ State_____

talk about PUNISHMENT!

Southern States Cutouts take it time and time again . . . in the laboratory and in the field to prove their Absolute dependability.

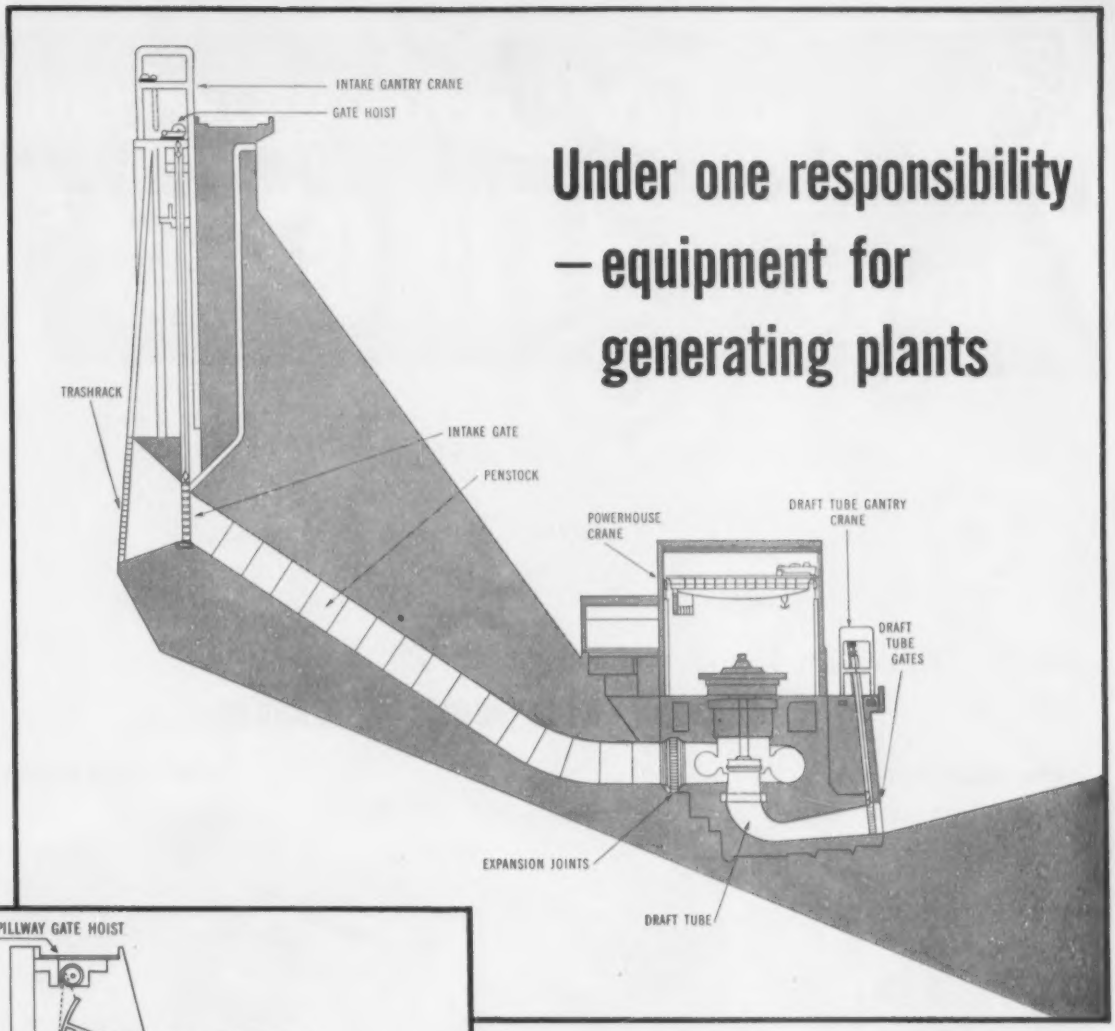
The modern Southern States cutout, like the type H-33-D shown here, is a rugged device capable of withstanding terrific electrical and mechanical stresses repeatedly. Like all Southern States cutouts it has been tested on thousands of installations and has been subjected to a multitude of laboratory tests.

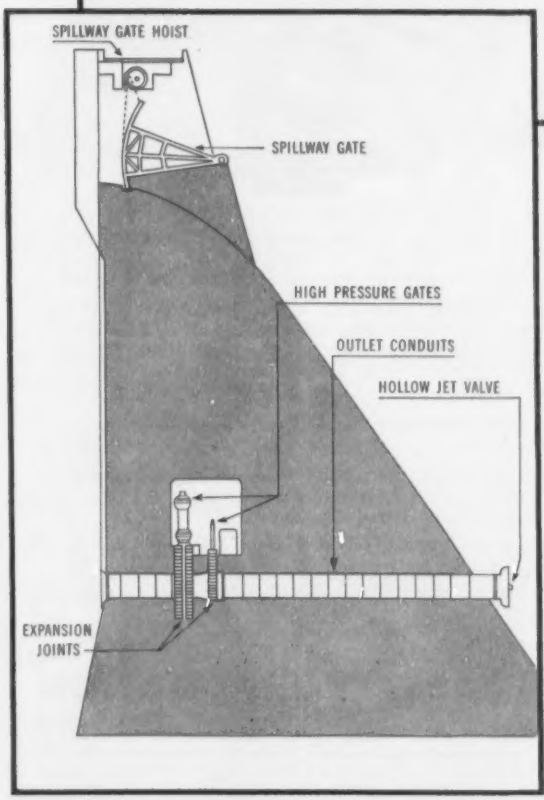
The present rugged form and dependability of performance of these cutouts is the result of this long experience. Positive latching, full dropout action, high pressure line contacts and self locking hinges are a few of the outstanding design features that have evolved and are now common to all Southern States cutouts.

For complete information write for Bulletin 530 C.

Southern States Equipment Corp.
HAMPTON GEORGIA

Under one responsibility —equipment for generating plants





● Under *one* responsibility, Paceco engineers, machines and fabricates many essentials for hydroelectric and steam power plants and waterworks.

You get from *one* source a cost-conscious engineering service and follow-through that eliminates divided responsibility.

Paceco service is available nationwide, at competitive prices, delivered and installed. We invite your inquiries.

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Paper Power Cable

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Starting with the development of the first Sector Type Conductor (for greater capacity with no increase in cable diameter), General Cable has pioneered many far reaching improvements designed to increase quality, improve efficiency and uniformity.

Today, General Cable manufactures the most complete line of Paper Power Cable to meet the needs of power utilities, railroads, large industrial power users, as well as municipal, state and federal governments.

TYPICAL TYPES: solid; low pressure gas or oil-filled; high pressure (pipe type) oil or gas-filled.

CONDUCTORS of copper and aluminum. **COVERINGS**: lead, neoprene over lead, submarine, and other armored types. Special types are also available for operations above 132,000 volts.

It pays to buy in *one* reliable place! Only at General Cable can you find all types of wire and cable for *any* job!

For today as well as tomorrow it pays to *wire BIGGER when building new and wire BIGGER when rewiring too.*

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There's no such thing as "ELKONITE® or equal"

Elkonite Contacts Combine...

- Good Conductivity
- Resistance to Sticking
- Resistance to Arc Erosion
- Impact Strength

...in a way that can't be matched!

For heavy duty circuit interrupting service Elkonite Contacts have no equal. They are made by an exclusive Mallory process that combines the desirable qualities of metals which cannot be alloyed. The high melting points of tungsten, molybdenum or their carbides are combined with the current-carrying ability of silver and copper through a unique impregnation process that is the result of 25 years of Mallory pioneering in the specialized field of contact materials.

It is not only the composition that makes Elkonite a superior contact material . . . it is the physical structure . . . the *way* the materials are combined.

The result is a contact material that has no equal in combining good conductivity, impact strength, resistance to arc erosion and sticking . . . qualities that mean top performance in heavy duty service.

When you specify Elkonite, the contacts in your products will last longer . . . give better performance. And Mallory has a complete family of contact materials that will meet all the requirements of circuit breakers and switch gear of any rating.

New Contact Catalog

Write for your copy today. It includes a discussion of Mallory materials and facilities for producing contacts and contact assemblies for every service . . . as well as valuable technical and design data.

Expect More... Get More from **MALLORY**

Serving Industry with These Products:
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
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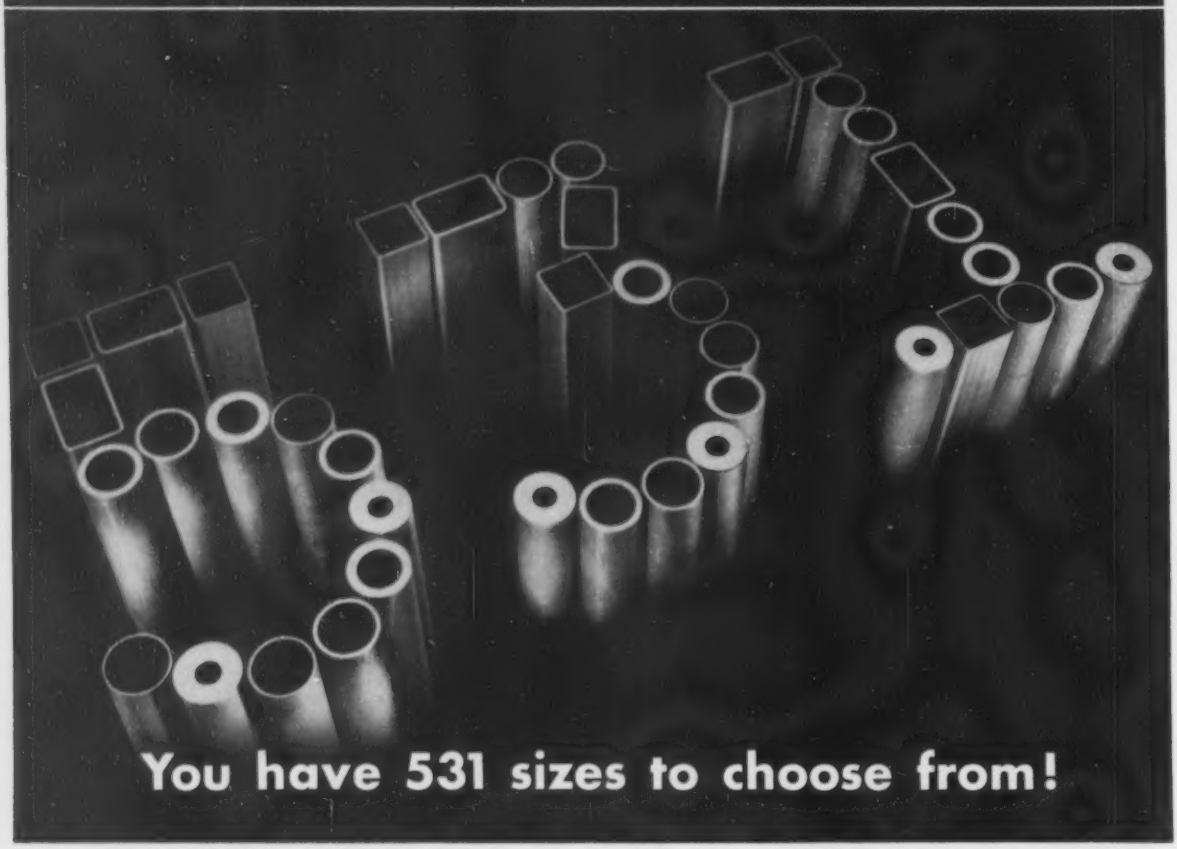
WHY IT PAYS TO BUY MECHANICAL TUBING FROM US



WE carry no less than 531 sizes of Shelby Seamless Mechanical Tubing and can fill orders promptly . . . by the inch or by the carload. No matter what your tubing needs, we can supply you with the best for the job -- tubing manufactured by the world's leading producer, National Tube Division of United States Steel.

Our experience in the field of tubing applications has often saved large sums of customers' money—for it is sometimes possible to substitute a more economical type of tubing than you had planned to use.

We carry everything you need. Call us for: mechanical tubing, round and square, seamless and welded; boiler tubing, pressure tubing and pipe; stainless steel tubing, seamless and welded, and stainless pipe.

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UNITED STATES STEEL

TELEPHONE SCIENCE GUIDES A PUNCH NO ENEMY CAN DODGE

(Upper left) – Nike's missile climbs to destroy an enemy, under guidance of complex electronic controls. A radar is shown at right. Nike (pronounced Ny'kee) is named after the Greek goddess of Victory.

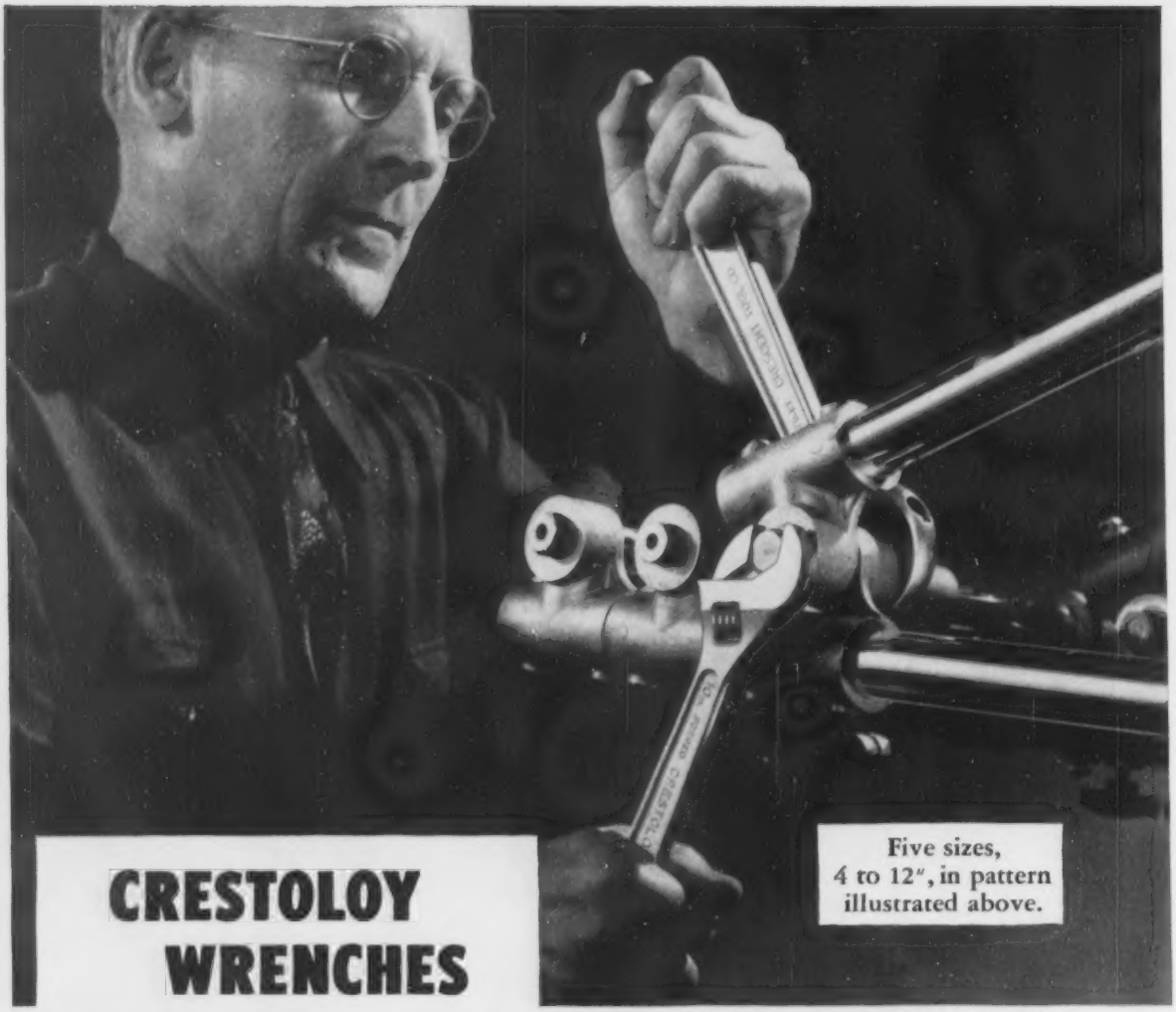
BELL TELEPHONE LABORATORIES

Is it possible to guide an anti-aircraft missile so that it will track down and destroy a rapidly maneuvering target? No one knew the answer for sure when the U. S. Army put this question to Bell Telephone Laboratories in 1945.

The special skills and techniques developed to create the nation's communications network uniquely fitted Bell scientists to answer this question. They recommended a new system, Nike, and then worked to bring it into being with engineers from Army Ordnance, Western Electric Company and Douglas Aircraft Company.

The first Nike installation has been made, and more will follow. Thus, America's defenses grow stronger through a new extension of frontiers in the communications art. It is a proud achievement of the knowledge and skills first developed at Bell Telephone Laboratories to make the nation's telephone service ever better.

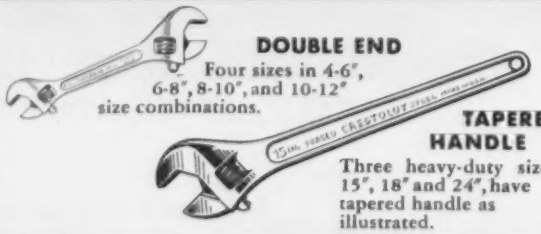
Improving telephone service for America provides careers for creative men in scientific and technical fields



CRESTOLOY WRENCHES

Five sizes, 4 to 12", in pattern illustrated above.

Forged from Crescent's own CRESTOLOY Steel, these fine wrenches are 200% stronger and 30% thinner than conventional adjustable wrenches. They are hardened by a selective induction process which guarantees longer life through a combination of surface hardness and interior toughness. Chrome plate finish. Sold by Industrial Distributors and Hardware Dealers everywhere.

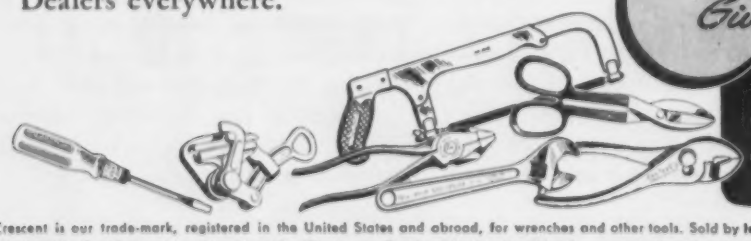


DOUBLE END
Four sizes in 4-6", 6-8", 8-10", and 10-12" size combinations.

TAPERED HANDLE
Three heavy-duty sizes, 15", 18" and 24", have tapered handle as illustrated.

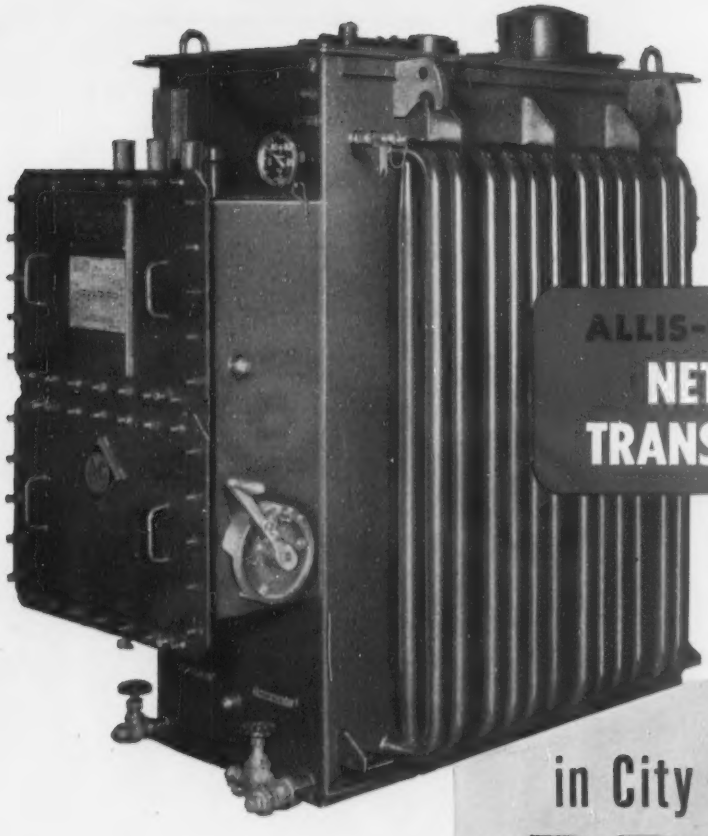
CRESCENT TOOLS
Give Wings to Work

Sign of the Artisan
Symbol of Excellence



Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK



ALLIS-CHALMERS
NETWORK
TRANSFORMERS

in City after City...

PROVED

By Performance

On utility systems all over the country Allis-Chalmers network transformers meet the test of reliable and economical service. New A-C network units are ordered repeatedly to take their place alongside the more than 1¼ million kva already installed.

You get unusual flexibility in choice. To simplify your application problems, Allis-Chalmers builds all three basic types: oil-filled, *Chlorextol* liquid-filled, and sealed dry type.

It will pay you to investigate the design and construction details of Allis-Chalmers network transformers before you order your next unit. Consult the A-C district office near you or write Allis-Chalmers, Milwaukee 1, Wisconsin, for more information.

Chlorextol is an Allis-Chalmers trademark.

Compact, low-loss design. Thermal capacities are high for severe load conditions. Sturdy, time-proven core and coil construction withstands repeated short-circuit stresses of network operation.

Safe, dependable tap-changing mechanism. Handle inserted through two-inch opening on cover operates mechanism. Handle cannot be removed unless it is in positive tap position. Cover location of handle entrance eliminates packing gland maintenance.

Threaded valve connections to tank are solder-wiped for extra protection. Valves are located for easy access. Globe-type valves with non-rotating seats close tight, avoid wear on valve seats.

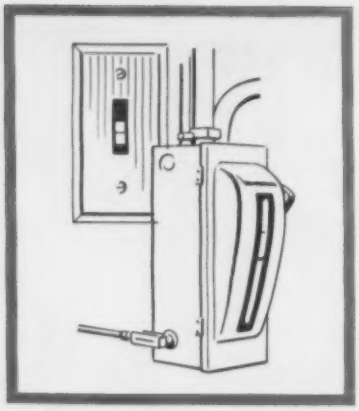
Spiral-wound gaskets have proved their superiority over other types of gaskets for sealing bushings in the tank wall in over 6 years' continual use. Alternate plies of preformed springlike metal and non-metallic fillers provide unusual resilience and actually adjust themselves to changes in operating conditions. Gaskets can be installed without cements or grease. They can be quickly removed if required and may be re-used if necessary.

Shot blast cleaning, three coats of baked-on paint formulated for high water resistance, and compound treatment of base and tubes in base area give superior surface treatment. A-4317

A-C ALLIS-CHALMERS

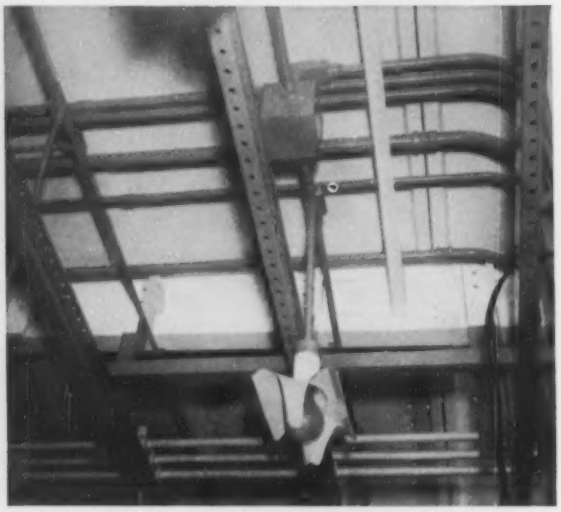
ALLIS-CHALMERS

For dependable service here . . . . .



USE REPUBLIC ELECTRICAL METALLIC TUBING HERE

There are no lines to turn, no threading, with Republic E.M.T. It's easier to install runs in cramped spaces, even where there are multiple bends, and still turn out a neat job.



Inch-Marks in the ½", ¾" and 1" sizes of Republic ELECTRUNITE E.M.T. help make accurate bends to fit in close quarters. Installation is easy, even though equipment has already been installed.

Republic E.M.T. is dependable, economical, and gives years of service life. In some utilities, it's been on the the job more than 15 years.

And that's one big reason why so many public utilities with a reputation for service use Republic Electrical Metallic Tubing.

Republic E.M.T. is the original lightweight, threadless rigid steel electrical raceway. With no threads to cut, the galvanized coating is unbroken. The installation is protected from end to end. It protects circuits against moisture, fire and mechanical injury. It's lighter. And with less weight to handle, installation costs come down.

So whether you're building or revamping, get all the facts about Republic "Inch-Marked®" E.M.T., the raceway that gives the protection of steel. Produced to A.S.A. Specification C80.3. Write for booklet SA-54.

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REPUBLIC ELECTRUNITE E.M.T.
"INCH-MARKED" THE MARK OF QUALITY

Made by the producers of ELECTRUNITE . . . The Original Electric Welded Boiler Tube

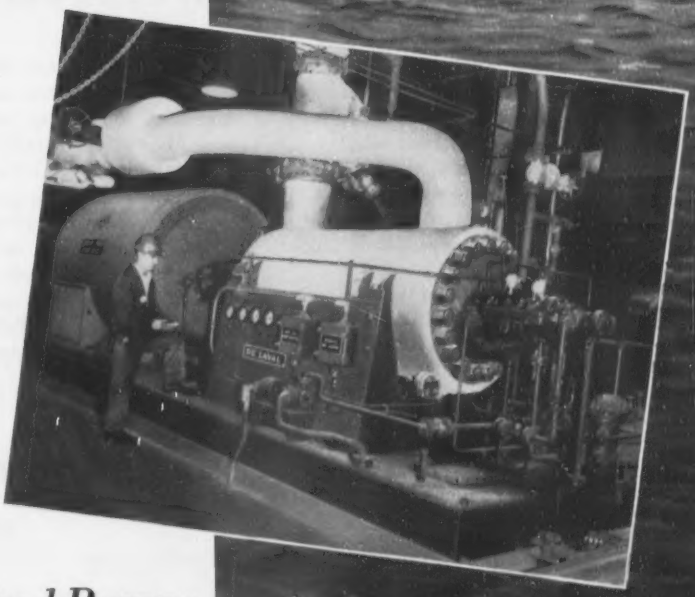
DE LAVAL
BARREL TYPE BOILER FEED PUMP

in new **Con Edison**
Astoria power station

This De Laval 11-stage barrel type boiler feed pump is now on the line in the new Astoria station of the Consolidated Edison Co. of New York.

The De Laval 8/6 pump operates at 129 psig suction pressure and delivers 1,570 gpm of 344 F water against 2,229 discharge pressure. Direct-connected at the end of the boiler feed pump shaft is a De Laval IMO pump for lubrication of the main pump and motor bearings. Also furnished is a motor-driven De Laval IMO auxiliary oil pump with pressure controlled switches.

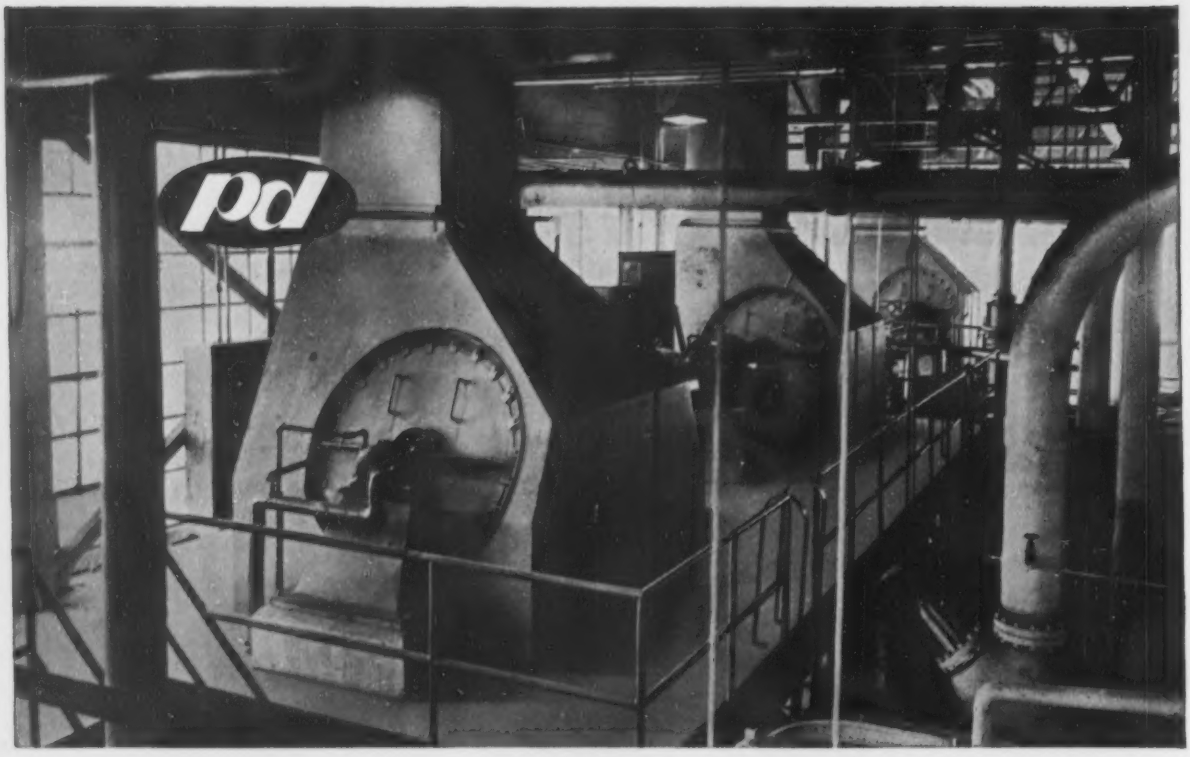
De Laval barrel type boiler feed pumps meet all the requirements of high pressure, high temperature boiler feed service. The distinctive De Laval design assures years of reliable operation with minimum maintenance.



DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY
861 Nottingham Way, Trenton 2, New Jersey

DL 256



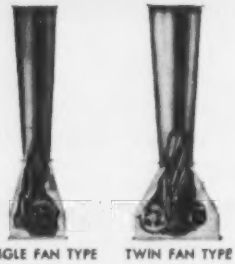
P-D Dust Collectors and Fan Stacks Provide Maximum Flexibility and Unit Efficiency at Western Electric

sturdy, self-supported units... clean cut layout arrangements

It takes steam—lots of steam—to keep Western Electric's big Indianapolis plant turning out millions of telephones each year. During processing, sizable quantities of steam are needed and in addition over a million square feet of factory and office space must be heated.

The system that solves this problem is designed to deliver 187,000 lbs. per hour of steam, from three 60,000 lb. per hour steam generators and a 7,000 lb. per hour, incinerator boiler. The four units are equipped with an integrated arrangement of Prat-Daniel Dust Collectors, Induce Draft Fans, Breechings and Stacks. Small diameter tubes in the P-D Collector develop a high centrifugal force, providing maximum operating efficiency even at widely varying loads. The straight P-D Fan Stacks are of sturdy self-supporting construction. Flow through arrangement reduces resistance, providing more efficient draft production.

Engineered by Allen and Kelly of Indianapolis in collaboration with Western Electric's engineers,



SINGLE FAN TYPE TWIN FAN TYPE

Stacks and Dust Collectors were project engineered by The Thermix Corporation.

You too can have specialized help in solving your dust and draft problems. Call or write Thermix today.

Ask for the new P-D Catalog 4P201.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 5, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

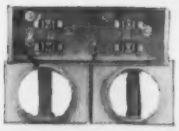
POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

Murray

Quality Equipment — serving the electrical industry for over half a century.

METERING EQUIPMENT

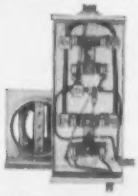
ROUND METER SOCKETS
10 types available.



SOCKET METER TROUGHS
Indoor gangable.

SOCKET METER TROUGHS WITH AND WITHOUT HUBS

Raintight type — horizontal.



Raintight type — vertical.

SOCKET METER MOUNTINGS — RAINTIGHT TYPE

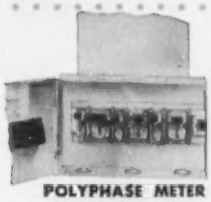
Medium duty, single phase and polyphase.

Heavy duty.
Up to 200 Amperes.

SOCKET METER ADAPTER
For "A" Base Meter Boxes.
Indoor and Outdoor.

"A" BASE METER CONNECTION BOX
Raintight type.
Two sizes up to 2/0 wire.

"A" BASE METER MOUNTING AND TEST CABINET
Indoor. Single phase and polyphase up to 200 Amps.



POLYPHASE METER MOUNTING AND TEST CABINET
C.T. current transformer cabinets available.

The *Crowsnest*
AERIAL LADDERS

New pedestal mount occupies least truck floor space. Fastest, easiest and safest operation. Made in three working heights — 29', 32'9 and 36'8.

COMBINATION METER SOCKET AND CIRCUIT BREAKER
Service Equipment.
One piece construction.

A. Tamper-proof Meter Seals, custom embossed.
B. Non-corrosive zinc strapping.

CABLE RACKS AND STANCHIONS
Light and heavy duty.
Porcelain insulators.

CURRENT LIMITING REACTORS
Dry type. Glass insulation.

Murray®

ADEQUATE WIRING — THE KEY TO THE MODERN HOME — SERVES AND SAVES

For complete information, write Dept. U2.

MURRAY MANUFACTURING CORPORATION
1250 ATLANTIC AVENUE, BROOKLYN 16, N. Y.

Service Entrance and Meter Equipment • Magnetic Hydraulic Circuit Breakers • Safety Switches (Types A, C & D). Current Limiting Reactors • Crows'nest Aerial Ladders • Utility Specialties

Visit OUR FACTORY!

No. 1
in a series of pictorial tours thru the Nelson Plant showing Nelson Electrical Equipment "in the making".

SWITCHBOARD ASSEMBLY BAY

In this section of our switchboard assembly bay, you see Nelson Instrument and Control Panels, Switchgear and High Voltage Motor Starters nearing completion.

WIRING MOTOR STARTERS

Here you see skilled workmen wiring a group of Nelson Class 420, Explosion-Proof, Combination Motor Starters.

OPERATIONAL TEST

Above photograph shows operational test being made on Nelson Class 431, Size 5, Reduced Voltage, Motor Starter Assembly.

MANUFACTURERS OF: Instrument and Control Panels • Benchboards and Consoles • "Centrol" Motor Control Centers • Switchgear — low voltage and high voltage • Unit Substations • Motor Starters, Circuit Breakers, Lighting Panels, Control Stations and Junction Boxes in watertight, dust-tight and explosion-proof enclosures • "Nelex" Mineral Insulated Heater Units

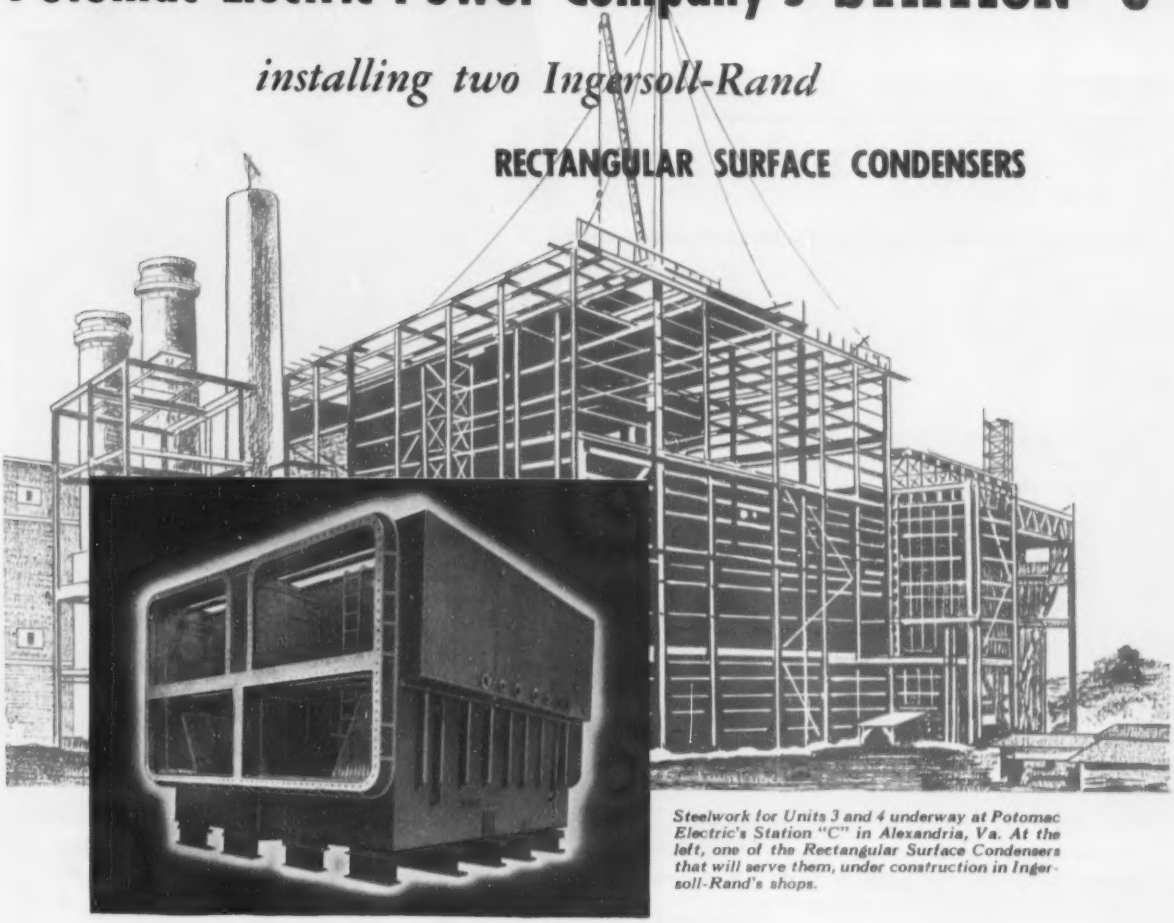
Write for a copy of our "Pictorial Index."

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

Potomac Electric Power Company's STATION "C"

installing two Ingersoll-Rand

RECTANGULAR SURFACE CONDENSERS



Steelwork for Units 3 and 4 underway at Potomac Electric's Station "C" in Alexandria, Va. At the left, one of the Rectangular Surface Condensers that will serve them, under construction in Ingersoll-Rand's shops.

I-R 70,000 sq. ft. surface condensers to serve 100,000 kw turbines for units 3 and 4

TO meet the ever-growing load demands of the Nation's Capital area, Potomac Electric is adding 200,000 kw to the capability of its Station "C" in Alexandria. Stone & Webster Engineering Corp. are the designers and constructors collaborating with the utility on this project.

Two Ingersoll-Rand Rectangular Surface Condensers have been selected to serve these latest 100,000 kw units. Each condenser will have an effective area of 70,000 square feet and will be served by two Ingersoll-Rand vertical circulating pumps that deliver a total of 60,000 gpm.

Other Ingersoll-Rand equipment at this station includes the condensate pumps, condensate booster pumps and compressors which supply station air.

In this installation, as in many others, the Ingersoll-Rand Rectangular design made the most effective use of the *rectangular* space available beneath the turbine. And through a perfected system of complete shop erection, where all parts are flanged and match-marked, no structural field welding is required. Installation is as simple as possible, considering the size of the equipment. For the complete story on I-R equipment for the power industry, call your nearest Ingersoll-Rand branch office.

Ingersoll-Rand

979-4 11 Broadway, New York 4, N. Y.

PUMPS • COMPRESSORS • VACUUM EQUIPMENT • TURBO BLOWERS • ROCK DRILLS • GAS & DIESEL ENGINES • AIR & ELECTRIC TOOLS

330,000 VOLTS	OVEC	4500 psi
200,000 KILOWATTS	NPG	$100,000

If the story of AGE progress in 1953 were put in a book, it would make a mighty volume. Just a few facts and figures, though, tell a lot about that progress and how AGE discharged its responsibilities last year to its service area, to customers, shareowners, employees, and to the nation.

330,000 VOLTS is the voltage of AGE's newest transmission network. Highest voltage line in America, it is a major step forward in the delivery of electric power with maximum economy from generating source to point of use.

200,000 KILOWATTS is the capacity of the newest generators installed in AGE plants. Three such units began operation in '53; two more are under construction. That's a million kilowatts of new capacity in all — or more than the System's *total* capacity less than twenty years ago.

OVEC means Ohio Valley Electric Corporation. It is a group of 15 private electric utility companies proving that private enterprise can perform an indispensable service of unprecedented magnitude. The job: to provide electric power to a great new atomic production center, the largest single electric customer in history. Three of the utilities that sponsor OVEC are AGE companies.

NPG, the five-company Nuclear Power Group, is another joint effort — a step into the future — in which AGE is taking a major part. Purpose of NPG: to explore exhaustively the techniques and economics of the atomic generation of electric power.

4500 psi, a new high in steam-pressure in a commercial generating unit, was adopted in 1953 as the basic design figure of a new unit for a major AGE plant. A milestone of roughly the same scientific import as exceeding the speed of sound, steam-generation at 4500 psi opens up a new era of steam-generation efficiency with the use of smaller equipment.

$100,000 a year is the savings estimated through the use of the "Penalty Factor Computer" now being built for AGE. With speed never before approached, it determines the most economical routing of power from several alternative sources to a given point of use.

* * *

AGE moved well ahead in '53, equipped itself well to move ahead still further.

American Gas and Electric Company

Operating Affiliates

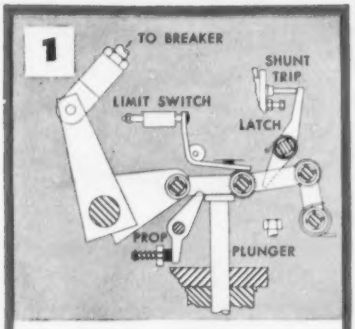
Appalachian Electric Power Company
Central Ohio Light & Power Company
Indiana & Michigan Electric Company
Kingsport Utilities, Inc.
The Ohio Power Company
Wheeling Electric Company
Kentucky and West Virginia Power Co., Inc.

ALLIS-CHALMERS
PROGRESS IN
Switchgear

Get the 3 features that assure power continuity

Allis-Chalmers offers the hydraulic type operating mechanism on breakers for 69-kv and higher ratings. Watch for it on other ratings!

1



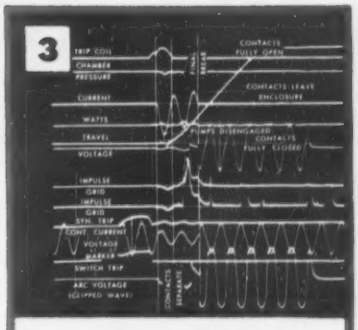
Mechanically trip-free operation gives high speed opening under all operating conditions. Simple uncoupling linkage permits contacts to open independently of closing piston position. Be sure your next breaker has fully mechanically trip-free operation.

2

Turbo Jet interrupter provides fast arc interruption with low arc energy release on both high current and difficult low current switching loads with leading or lagging power factors. Device utilizes bayonet type contact and high speed sickle contact.

Turbo Jet is an Allis-Chalmers trademark.

3



Completely tested — These breakers have been electrically tested to 10,000,000 kva. In addition, each Allis-Chalmers breaker is completely assembled and mechanically tested before shipment to assure easy assembly and proper operation in the field.

A-4289

GET MORE INFORMATION! Call your nearby A-C district office, or write Allis-Chalmers. Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Porcelain Products' SECONDARY SERVICE MATERIALS

THE INDUSTRIES MOST COMPLETE LINE

Porcelain Products' service mast KIT

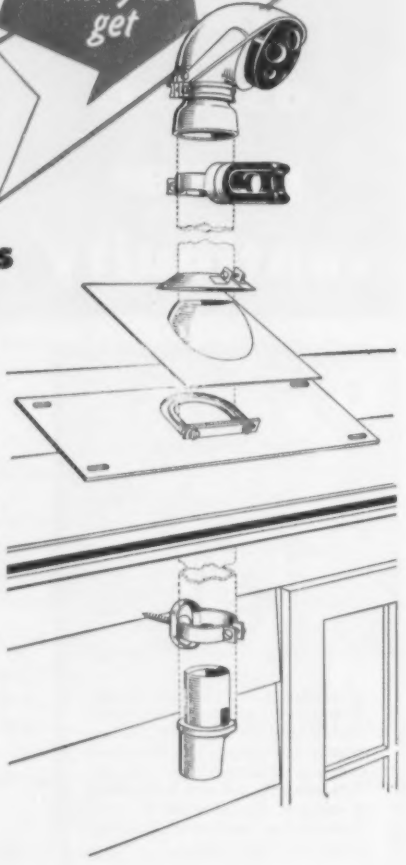
Everything furnished

but the house and conduit

2076 SERVICE MAST KIT

Here's what you get

for Ranch type homes



Available Now!—a Service Entrance Mast kit complete to every detail—including roof flashing. Even necessary bolts, nuts, lag screws, and nails. These articles make up the new Porcelain Products' service mast kit that you'll put up and forget. All components of the kit can be *installed by an electrician, with electricians' tools.*

Here is a list of the parts:

- √ 1¼" UL approved Service Entrance Cap
- √ 1¼" to 2" Bell Reducer to adapt service cap to conduit
- √ Galvanized Roof Flashing and Storm Collar
- √ Roof Mounting Plate of new and original design
- √ Conduit hanger with 2¼" lag screw attached
- √ Slip-fitting offset reducer with interior grounding device
- √ All necessary bolts, nuts, lag screws and nails
- √ *Plus*—Porcelain Products famous 2061-C Pipe Mounting house brackets as specified.

Write for details today!

60 years **Porcelain Products, Inc.** PP INC.
FINDLAY, OHIO

General View of Bremo Plant
Virginia Electric and Power Co.
Stone and Webster Engineering Corp.
Consulting Engineers

Bartlett-Snow coal handling at *Bremo*

● The illustration above shows both the original building and the new addition of this 60,000 KW plant. All equipment including the track hopper, duplex feeder, 1326′ of belt conveyors, the 70′ dust tight flight distributor in the new addition, and the 111′ distributing belt and belt driven tripper in the original building were detailed and fabricated in our shops and installed by us to Stone and Webster's specifications. For maximum efficiency and fixed unit responsibility, let the Bartlett-Snow coal handling engineers, work with you on your next job.

View of Dust Tight Flight Conveyor
Distributing Coal to Bunkers (New Addition)

View of Belt and Belt Driven Tripper
Distributing Coal to Bunkers (Old Building)

DESIGNERS ENGINEERS

BARTLETT-SNOW
CLEVELAND 5, OHIO

FABRICATORS ERECTORS

"Builders of Equipment for People You Know"

"Our new Dodge truck is a better deal for me and for my boss, too!"

Our new Dodge "*Job-Rated*" trucks have proved a better deal in handling ease, visibility, comfort and power. You, too, can save time and money, work and effort with these great new trucks. Find out today why Dodge means a better deal all around!

YOU GET—A Better Deal In Steering! Sharp 39° turning angle and short wheelbase design make Dodge the sharpest turning trucks on the road. That saves you *time!*

YOU GET—A Better Deal In Seeing! Big 951 sq. in. windshield of Dodge cab is largest of any popular truck. All-around visibility is tops, too, for safer driving.

YOU GET—A Better Deal In Sitting! The 16-inch-high Dodge seat is deep and comfortable enough to be in your living room! Plus easy-to-reach controls and dispatch box.

YOU GET—A Better Deal In Power! You save on maintenance because every Dodge engine . . . V-8 or Six . . . has such long-life features as exhaust valve seat inserts, chrome-plated top piston rings and positive-pressure lubrication.

New Dodge trucks give A BETTER DEAL FOR THE MAN AT THE WHEEL—and a better deal for the man who pays the bills. Test-drive and learn how a Dodge makes driving easier and does more work in less time. Give your Dodge dealer a call. He'll be glad to show you.

DODGE
"Job-Rated" TRUCKS

TUNE IN: "Break the Bank," Sunday TV—"The Roy Rogers Show," Thursday radio—"Make Room for Daddy," Tuesday TV.

TWO THINGS to remember --

FOR DEPENDABLE
GROUNDING PROTECTION

1

DRIVE

Copperweld
TRADE MARK

SECTIONAL
GROUND RODS

DEEP

FOR YEAR 'ROUND
PROTECTION

2

MEASURE

RESISTANCE OF EACH SECTION

ALLOW FOR
SEASONAL
VARIATION

POSITIVE
YEAR 'ROUND
PROTECTION

NEW BOOKLET
"Practical Grounding"

Its 36 pages are packed with the latest authoritative information on GROUNDING. A copy belongs in the files of every engineer responsible for planning reliable low-resistance grounds. Write for your copy today.

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION
Glassport, Pa.
For Export: Copperweld Steel International Company, New York

TOP PERFORMANCE FROM PROTECTIVE EQUIPMENT DEPENDS ON LOW-RESISTANCE GROUNDS

THE STRAND WITH

The Coating That Really Protects

Every inch of every wire in Bethlehem strand is "armored" – tightly encased in a rust-resisting, life-prolonging jacket of zinc. This zinc coating, applied electrolytically by a method called bethanizing, is smooth, uniform, ductile. Even severe bending doesn't bother it. You will never have the problem of cracking or peeling.

When a coating won't peel, rust has a pretty tough job getting started. And as long as rust is kept from gaining a foothold, the primary cause of strand disintegration is eliminated. That's why bethanized strand will see you through for years!

Another good point: the bethanized coating is available in *three* different weights, so that strand life can always be matched to line life. Weight A is equivalent to extra-galvanized; Weight B is twice as heavy as A; Weight C, three times as heavy as A. Thus, with three coatings to choose from, you can select the one whose life expectancy equals that of your line.

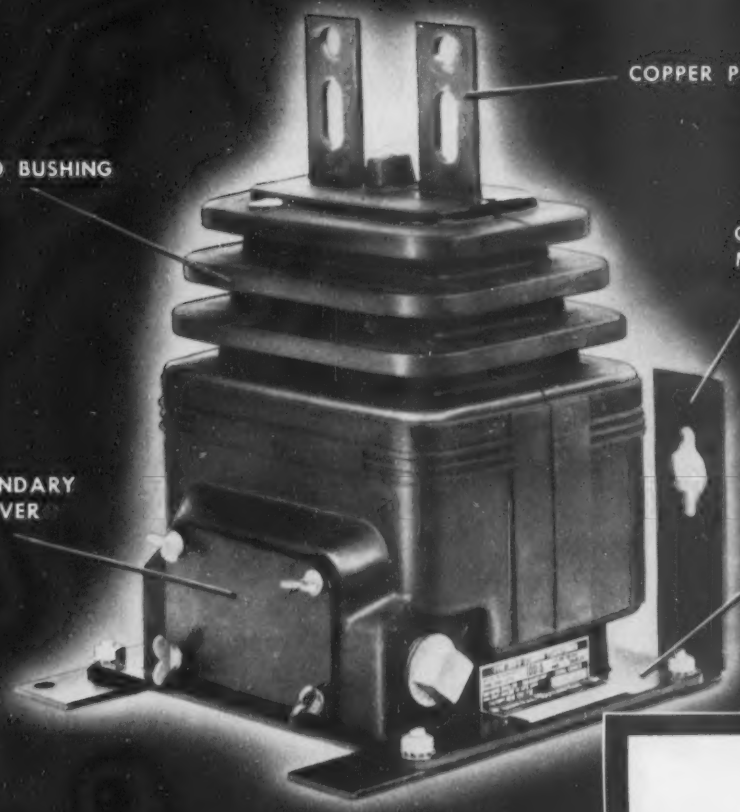
Ask for full details of Bethlehem strand with the bethanized coating. The strand is furnished, of course, in all the usual grades – common, siemens-martin, high-strength, extra-high, and utilities.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHANIZED STRAND

BETHLEHEM STEEL



G.E. designs light, compact, 5 KV current transformer with high resistance to corrosion

One third smaller and lighter, the new butyl-molded, outdoor, Type JKW-3 transformer is easier to install and maintain.

Almost completely corrosion-proof, this new General Electric current transformer is the first butyl-molded transformer designed for 5000-volt outdoor application. This revolutionary design has virtually eliminated maintenance.

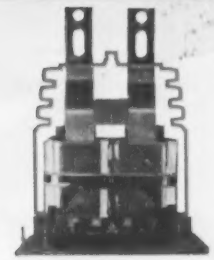
CORROSION-RESISTANT materials are used in all exposed metal parts. The case and primary bushing are butyl rubber. The butyl also serves as insulation and as an important factor in the new Type JKW-3's high mechanical strength.

EASIER TO INSTALL, this new G-E current transformer can be mounted in any position for bottom-, side-, or top-connected installations. The lightweight and smaller size facilitates installation and handling.

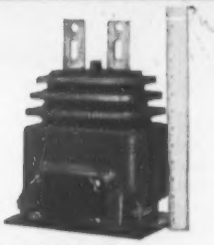
ACCURACY CLASSIFICATION of the Type JKW-3 transformer is 0.3 at burdens: B-0.1 to B-2.0. Ratings are from 10 to 800 amperes.

FOR MORE INFORMATION, contact your nearest G-E Apparatus representative, or write for Bulletin GEC-1222 to: Section 604-40, General Electric, Schenectady 5, N. Y.

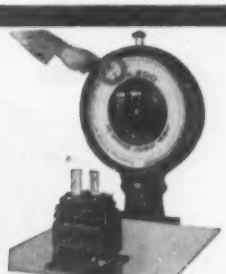
GENERAL ELECTRIC



1 BUTYL-MOLDED



2 COMPACT
only 12¾ in. high



3 LIGHTWEIGHT
only 42 lbs.

give those bright young eyes
a chance to stay bright with

GUTH SCHOOL LIGHTING

... sight-saving, low-brightness. No glare and gloom to haunt the classroom ... no torturing eye-strain. Easier lessons, healthier, happier students and teachers.

Fluorescent or incandescent—economical in purchase, installation and maintenance.

Write for details on Guth school lighting today.

THE EDWIN F. GUTH CO. • ST. LOUIS 3, MO.

Leaders in Lighting since 1902

Iver C. Dixon, General Sales Manager of Atlantic City Electric Co., declares...

"We've increased commercial cooking revenues 600% in 5 years!"

5 years ago our annual commercial cooking revenues averaged under $50 for each of the 1200 restaurants, hotels, drive-ins and institutions in our territory. Today this figure tops $300—an increase of 600%.

In 1953 alone our income from the food-service industry went up $100 per establishment. That's $120,000 in new revenue. (New cooking load for the year topped commercial lighting load by a pretty fair margin.)

By the end of 1954 our income from commercial cooking will top $530,000. And from a source that 5 brief years ago produced negligible revenues.

Funny thing about this commercial cooking load, though . . . if we eased up on our promotional drive tomorrow (which, incidentally, we have no intention of doing!), new revenues would quickly slip back to the old levels.

That's because there's real competition for this much-sought-after load. (Unlike lighting, refrigeration and air-conditioning, it doesn't *have* to go electric, you know!)

Like a good many other utilities in this country, we're sold on commercial cooking . . . because of its high revenue . . . its really wonderful characteristics (you'll be surprised to discover how much of this load is off-peak) . . . and because it represents the most valuable service we could possibly render our food-service customer.

Frankly, we're in the commercial cooking field to stay.

WE SUBSIDIZE WIRING, BACK SALES WITH 24-HOUR SERVICE

L. C. Roe, commercial-industrial sales supervisor for A.C.E., discusses 7-Point Commercial Cooking program:

1 We maintain a year 'round commercial cooking activity intensified by a special 3-4 month campaign.

2 Our 14-man all-purpose team devotes 25% of its time to commercial cooking. The team's selling average for 1953 was 4.8 kw added per installation. The team's top man, Bill Howell, averaged 5 kw.

L. C. Roe

3 Elmer Williams, our commercial cooking specialist, is available at all times for consultation, and provides complete kitchen layout service.

4 We have top management's enthusiastic support.

5 We make a wiring allowance on all installations over 25 kw.

6 Loan equipment is always available for trial installation, or emergency use.

7 We offer 'round-the-clock service.

An example of public service performed by A.C.E. through the promotion of commercial electric cooking: famed Hackney's restaurant replaced 23 non-electric fryers with just 10 electric models with resultant higher efficiency.

THE TIME IS NOW

As Mr. Dixon pointed out—the field is intensely competitive, but highly profitable, carrying the added incentive of contributing to the modernization of the nation's food-service facilities.

Why not share our commercial cooking services and programs? Write and I will give your letter my personal attention.

Orin E. Wolf.

Orin E. Wolf, Vice President, Hotpoint Co.

Hotpoint ALL ELECTRIC Commercial Cooking Equipment

Hotpoint Co. A Division of General Electric Company

Commercial Equipment Department, 265 South Seeley Avenue, Chicago 12, Illinois

DROP-FORGED

Stronger-Lighter

High Slip Strength

MINIMUM POWER LOSS

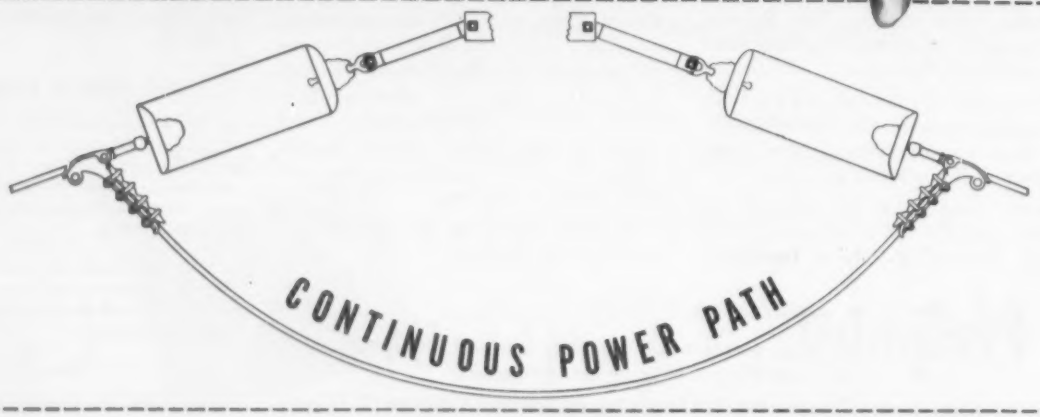
Increased Conductor Life

Economical

Efficient

Full Range of Sizes

Cool Operation



for GREATER STRENGTH

BTC

M.P.L. ALUMINUM

STRAIN CLAMPS

for A.C.S.R. and All-Aluminum Conductors

M.P.L. MINIMUM POWER LOSS
It has been proved that the use of a non-magnetic Aluminum Clamp Body reduces hysteresis and eddy current losses to a minimum. The actual power loss in M.P.L. Clamps is approximately one-tenth of that in all-ferrous Clamps.

HEATING EFFECT
High amperage current raises the temperature of the conductor within ferrous Clamps beyond safe limits, anneals the conductor, materially reduces its strength and fatigue resistance and has been the current-limiting factor on some systems. The clamped conductor and the M.P.L. Clamp operate at lower temperature than that in the span.

HIGH STRENGTH, LIGHT WEIGHT
Forgings, in any metal, are invariably employed where better strength, soundness and finish are required than can be obtained by other processes. Forging produces a fine, close-grained structure with grain flow following the contour of the part. It develops optimum mechanical properties and ability to withstand severe loading, sudden shock and frequent reversal of stress. The M.P.L. Clamp Body is Forged Aluminum alloy, fully heat-treated. In the heat-treated condition, the ultimate strength and hardness are more than twice (and the yield strength and endurance limit more than three times) that of alloys used in other processes. Catalogued strength ratings are conservative and are exceeded in actual tests. Undesirable weight is eliminated without sacrifice of strength.

SLIP STRENGTH
High holding power is attained by the combination of snubbing action and wave form body and keeper.

CONDUCTOR LIFE
M.P.L. Strain Clamps are designed to minimize the effects of conductor vibration. The light weight assembly with separate, rather than integral, connecting arms is free to oscillate at a point near to its center of mass, effecting a low moment of inertia and allowing the free passage of vibration waves. Generous snubbing radius of Clamp mouth prevents severe concentration of bending and tension stresses.

CORROSION
The close-grained, non-porous structure of the Forged Aluminum Alloy Body effectively prevents the destructive internal seepage of corrosive elements, disintegration of metal and eventual failure.

ECONOMICAL, PERMANENTLY EFFICIENT
M.P.L. Strain Clamps offer low initial cost—easy, quick installation—no cutting or lowering of the conductor— no special tools or cumbersome installation devices—no trouble inviting bolted jumper loop connectors—and no interruption of continuous power path through the jumper loop.

FULL RANGE OF SIZES
The M.P.L. line offers a choice of exactly the right Clamp for each size of A.C.S.R. or All-Aluminum Conductor. The close dimensional fidelity of the die-forged parts makes unnecessary any bore size allowance for manufacturing variations in the Clamps.

Specify BTC M.P.L. Aluminum Strain Clamps from your insulator manufacturer. They are an important part of BTC's complete line of forged transmission line hardware.

Sold Through Your [illegible] Manufacturer Only
Drop Forged BTC ***Hi-Line Hardware***

The BREWER-TITCHENER
Corporation
Cortland · New York

SHE WON'T TAKE NO FOR AN ANSWER

When the American housewife wants more electric power, she won't take no for an answer. Neither will industry in producing more and better products for every need.

That's why America's power companies, today doing the tremendous job of supplying an all-time peak demand, are at the same time planning . . . and building . . . for the still greater capacity that will be needed tomorrow.

Many utility companies have found that Ebasco can help them determine whether additional facilities are needed—where, what and when to build. Ebasco's specialized services to the electric power industry encompass every aspect of expansion—from studies of present and potential markets, long-range system planning, financing—right up through the actual design and construction of any type of new plant or station.

In its half-century of service to business and industry, Ebasco has served more than 145 electric companies covering every phase of operations. Our booklet, "The Inside Story of Outside Help," blueprints the value of this experience to your company. We will be glad to send you a copy. Write Ebasco Services Inc., Dept. M, Two Rector Street, New York 6, N. Y.

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BUSINESS CONSULTANTS

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Appraisal · Budget · Business Studies
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Industrial Relations · Inspection & Expediting
Insurance, Pensions & Safety · Purchasing · Rates & Pricing
Research · Sales & Public Relations · Space Planning
Systems & Methods · Tax · Traffic · Washington Office

Operation "Brain Center"

This room is the control, nerve, or "brain center" of the modern public utility system. From this room control cables carry impulses that operate switches, remote control devices, and telemetering equipment. Here men, by means of remotely-controlled switches, set up and break down circuits. It is here that failures of equipment and outages caused by the elements are circumvented.

All of these operations depend upon the sure and dependable performance of Simplex Control Cables. They must be ready to operate under every conceivable kind of condition. These control cables bear a measure of responsibility entirely out of proportion to their size. But they do it with absolute dependability. The safety of many millions of dollars of public utility equipment rests upon these slender cables and the equipment they control.

Simplex Control Cables are made in three styles: Anhydrex-insulated and neoprene-jacketed, Polyethylene-insulated and Plastex-jacketed, and Plastex-insulated and Plastex-jacketed. There is a size and a style to meet every operating condition on your public utility system, whether it be to operate equipment at a distance, for telephone and communication circuits, for telemetering devices. Whatever the need, be sure that the vital connecting link between the "brain" and the equipment is Simplex Control Cable.

Your local Simplex representative will be glad to help you with any problem you may be facing which has to do with cables.

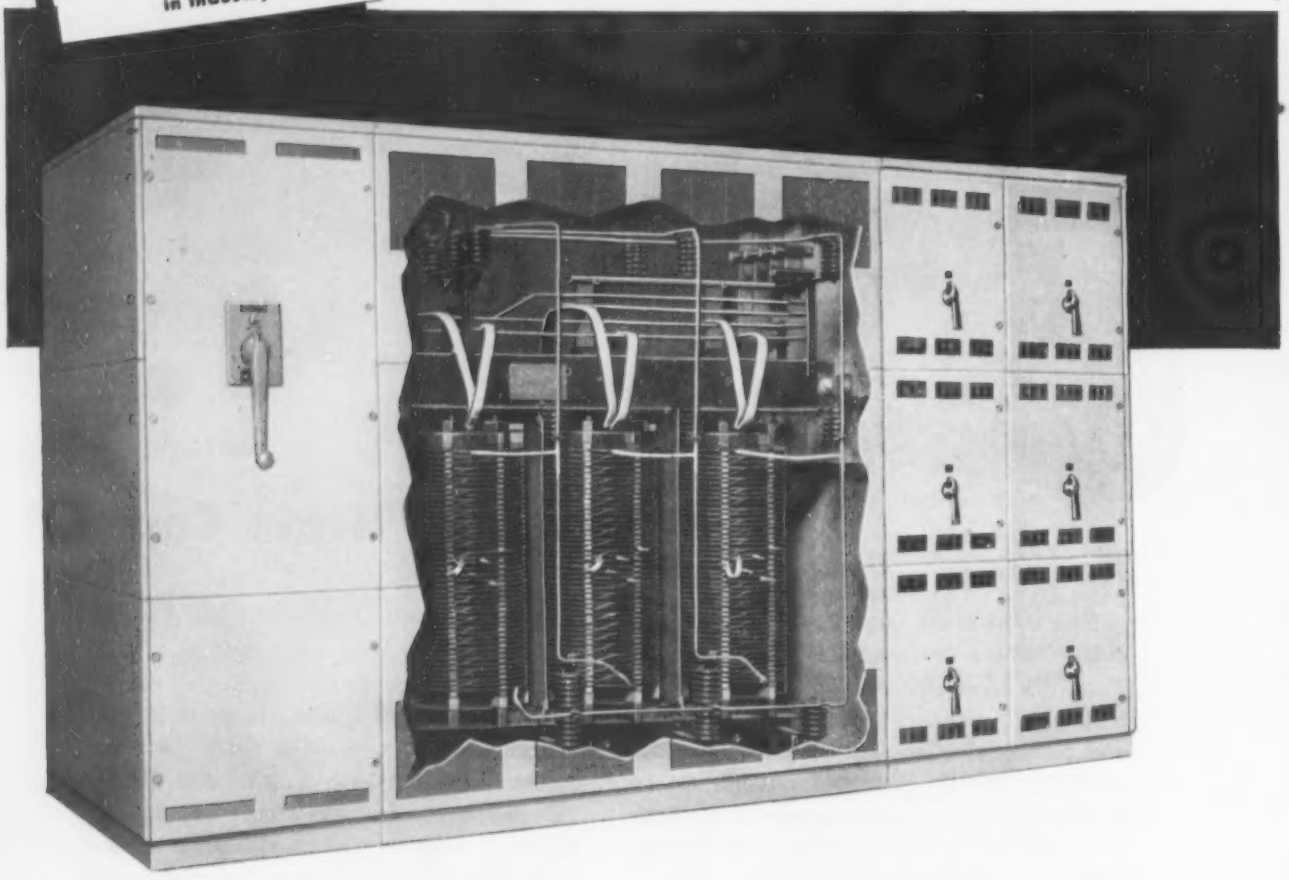
Simplex Control Cables

products of

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

Wagner®
TRANSFORMERS
... the choice of leaders in industry

for a reliable load-center



The importance of the transformers in your plant power distribution system cannot be overemphasized. If a switch or a circuit breaker fails, only a part of the system is usually affected—but if the *transformer* fails, the entire system is dead. When you specify Wagner, you can be sure of a dependable, continuous flow of power.

Wagner manufactures both dry type and liquid-filled Unit Substation Transformers, in ratings through 2000 kva, 15 kv and below—you can choose a type and rating exactly *right* for your requirements.

Bulletins TU-56 and TU-13 give full information. Write for your copies today.

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AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

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power supply---*always specify...*

Wagner

PREDESIGNED Dry Type Transformers

you gain because:

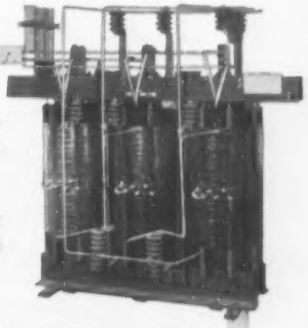
- **you save shipment time**
- **you save job engineering costs**
- **you get full Wagner Quality with switchgear of your choice**

Wagner "Predesigned" Dry Type Substation Transformers are carefully engineered to meet heavy industrial demands. Predesigning completely eliminates individual job engineering . . . reduces your costs . . . and saves shipment time.

Wagner "Predesigned" Dry Type Transformers consist of standardized core and coils rated from 112.5 to 2000 kva. All Unit Substation builders have the information and coordination necessary to use these transformers with switchgear of your choice.

You can specify the Wagner Transformer that exactly meets your load-center distribution requirements—be assured of full Wagner Transformer Quality—and gain a substantial advantage in delivery time and in cost.

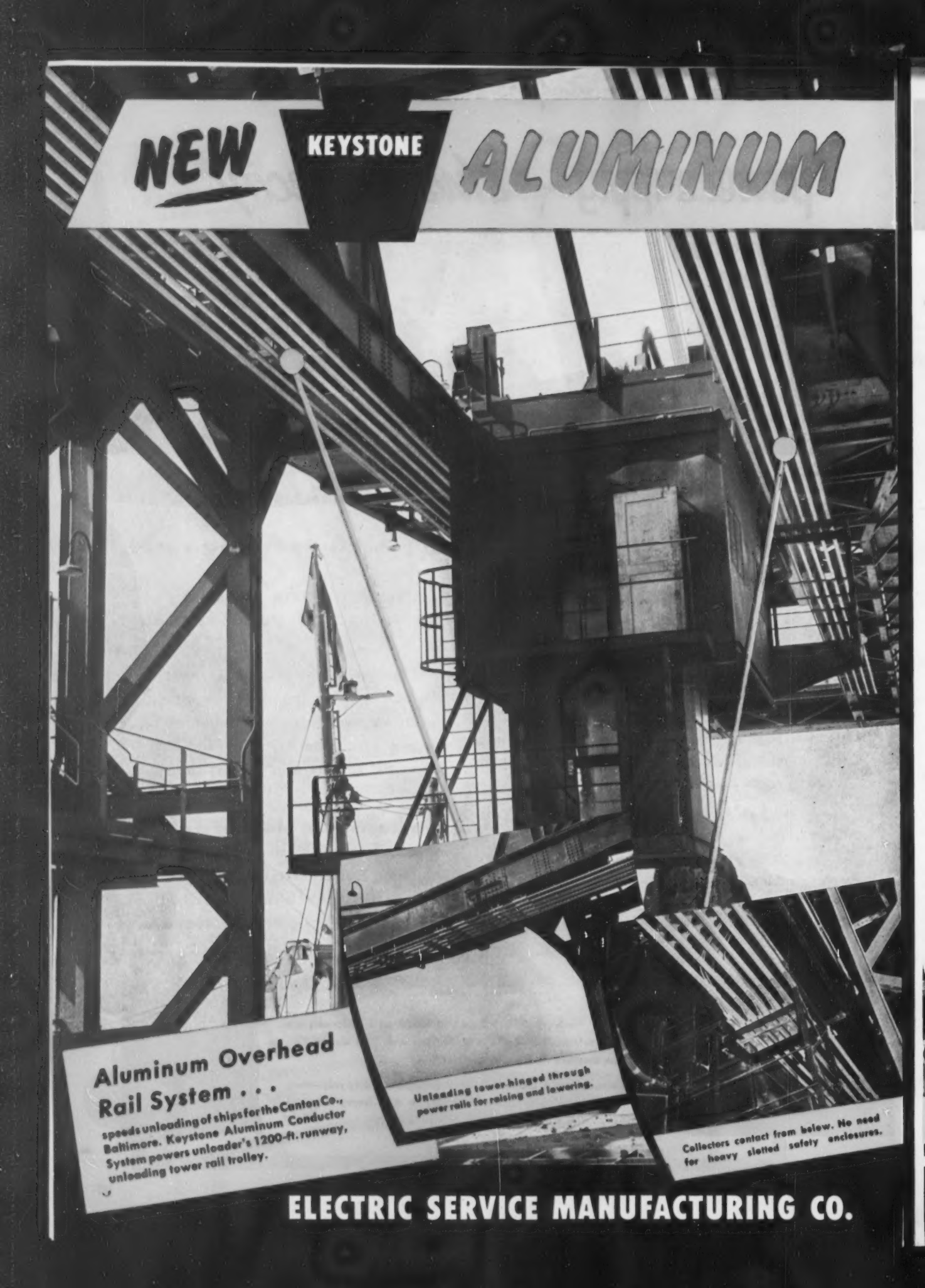
Investigate the many advantages of specifying Wagner "Predesigned" Dry Type Unit Substation Transformers for your next load-center installation. Consult the nearest of our 32 branch offices, or write direct to us.



Wagner "Predesigned" Dry Type Unit Substation Transformers are for indoor installation. Because of their relatively light weight, they can be used in multi-story buildings.

These transformers are not designed for minimum duty only—they have all the Wagner quality necessary to meet heavy industrial demands. You *can* depend on Wagner for quality.

NEW KEYSTONE ALUMINUM



Aluminum Overhead Rail System . . .

speeds unloading of ships for the Canton Co., Baltimore. Keystone Aluminum Conductor System powers unloader's 1200-ft. runway, unloading tower rail trolley.

Unloading tower hinged through power rails for raising and lowering.

Collectors contact from below. No need for heavy slotted safety enclosures.

ELECTRIC SERVICE MANUFACTURING CO.

CONDUCTOR SYSTEM

PROVED 7 WAYS BETTER THAN THE STEEL THIRD RAIL SYSTEM

Here's why it paid the Canton Company of Baltimore to switch from conventional conductors to Keystone Aluminum throughout for their new high-speed ore unloader and 1200-foot-long 2300-volt main runway.

1 CORROSION REDUCED

Salty dampness doesn't faze the Keystone Aluminum System. Cleaner contact surfaces protected from dirt and damage.

2 LOW VOLTAGE DROP

The non-magnetic qualities of the Keystone Aluminum System increase current capacity through lower reactance and close conductor spacings.

3 GREATER CAPACITY

1000 amp rating provides capacity for additional equipment without boosters or multi-point feeds.

4 SENSITIVE CONTROL

Corrosion resistant Keystone Aluminum Systems assure positive contact on most sensitive control circuits.

5 DEADWEIGHT SLASHED

Lighter than steel. Needs no heavy supporting structure. Compact 2300-volt runway safely protected with standard enclosure.

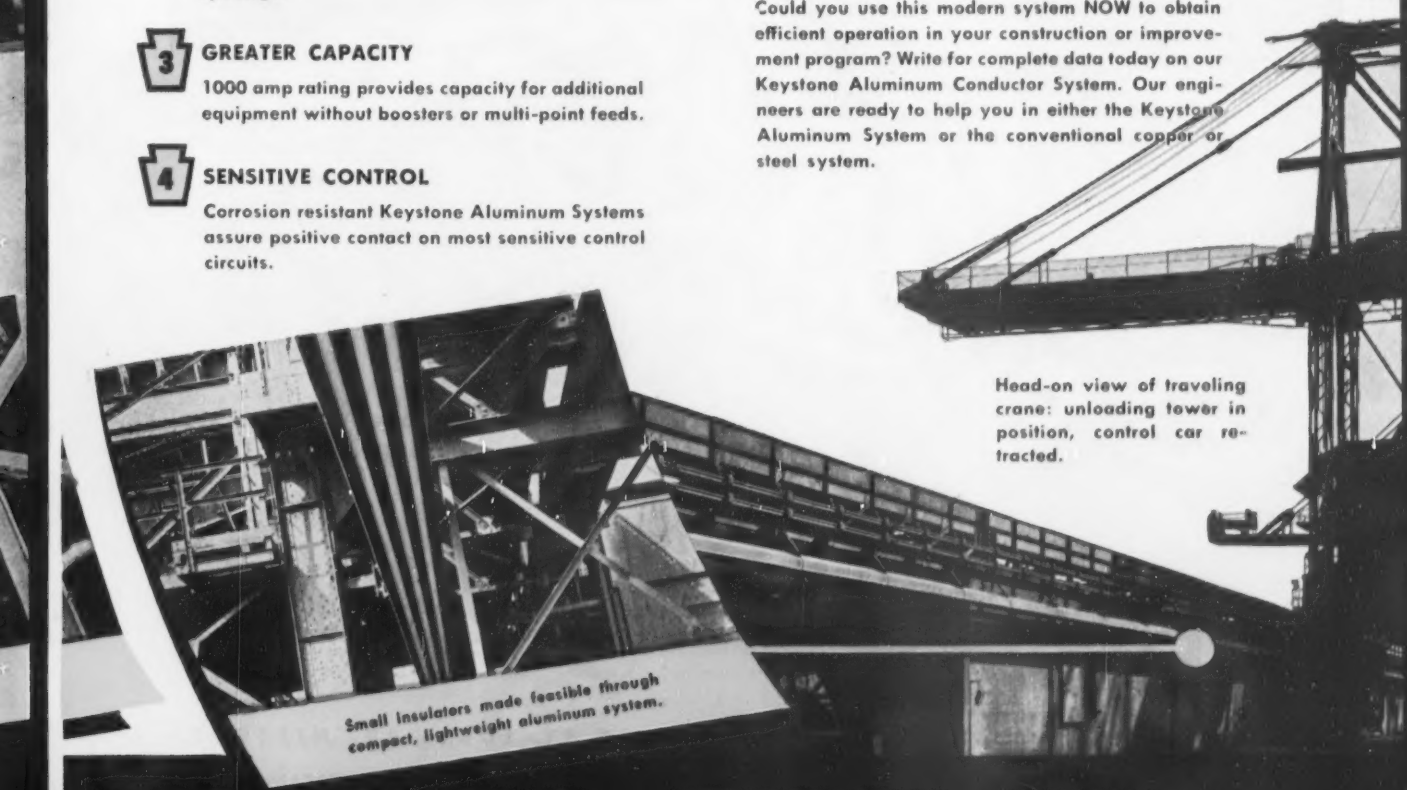
6 LONGER COMPONENT LIFE

Multiple contact collectors prevent arcing and heating. Less vibrating weight saves insulators. Smooth, clean contact surfaces and low current densities mean longer shoe life.

7 INSTALLATION EASED

Compact design, pre-fabricated, lightweight units mean lower labor and installation costs for either open or closed systems.

Could you use this modern system NOW to obtain efficient operation in your construction or improvement program? Write for complete data today on our Keystone Aluminum Conductor System. Our engineers are ready to help you in either the Keystone Aluminum System or the conventional copper or steel system.



Head-on view of traveling crane: unloading tower in position, control car retracted.

Small insulators made feasible through compact, lightweight aluminum system.

Philadelphia 32, Pa.

Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto

POWER . . .

MOLONEY ELECTRIC = { BETTER PERFORMANCE
GREATER RELIABILITY
LESS MAINTENANCE

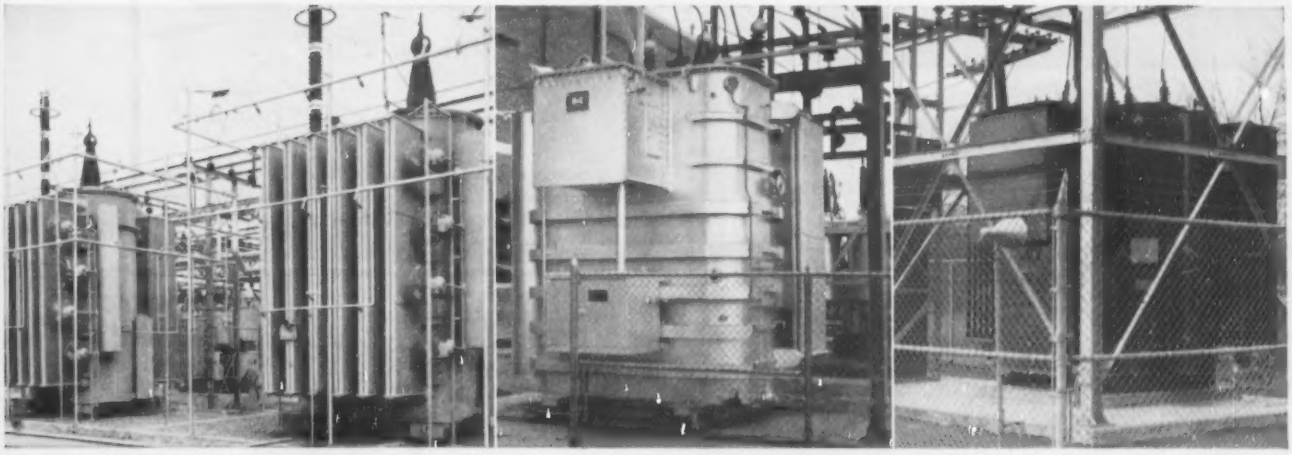
FACTORIES AT ST. LOUIS 20, MISSOURI

The MAINSPRING of INDUSTRY

Modern industry requires a power source as dependable as the mainspring of a fine watch—central station electric power. But just as the accuracy of any watch depends as much upon jewelled bearings and gears that transmit the energy of its spring, your electrical system's dependability relies heavily upon the equipment which transforms and regulates the flow of power.

Moloney's famous greater "margin of safety" will give your system clock-like dependability . . . this means that Moloney Power Transformers stay on the job continuously and efficiently. The engineering, design and fabrication superiority that has been the mark of Moloney for 57 years results in transformers that perform better, with greater reliability and have longer operating life. Consider all the advantages that Moloney offers . . . and you'll install Moloney *all along the line.*

ME53-41



MOLONEY ELECTRIC COMPANY

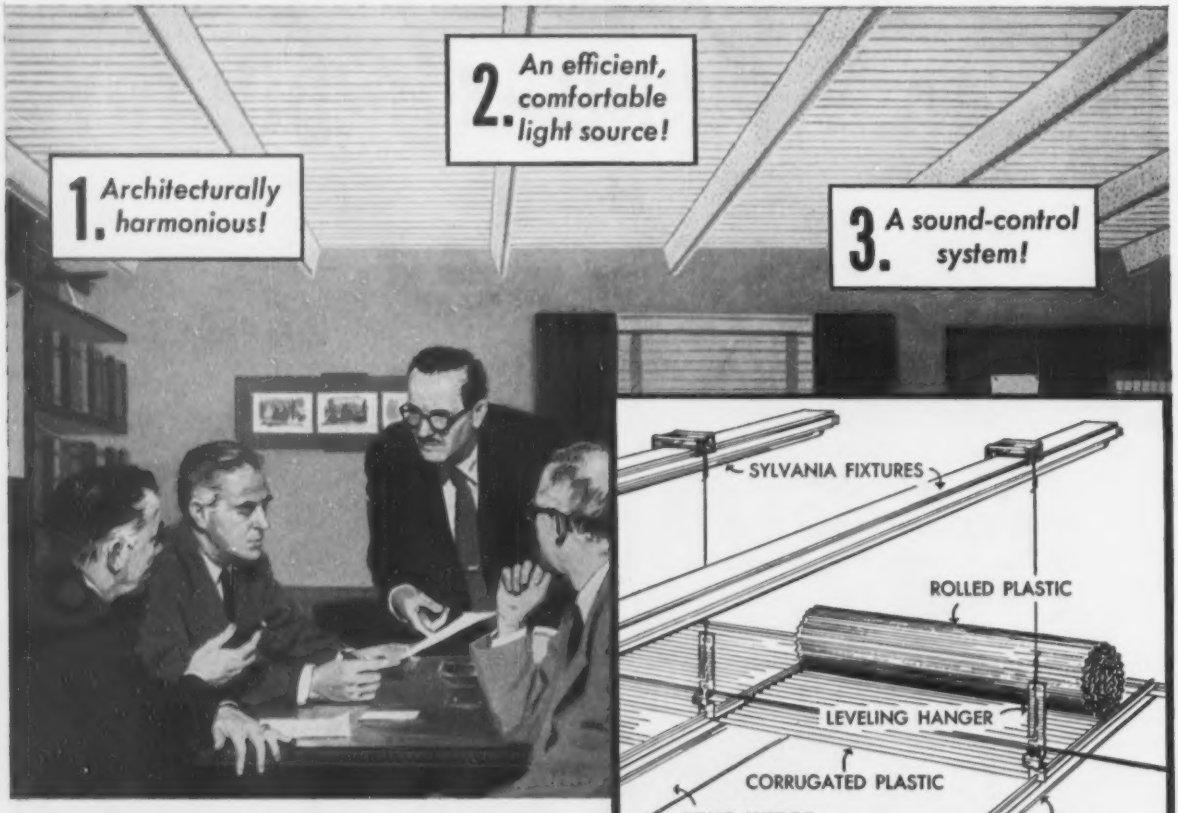
Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Ratio Control Transformers • Unit Substations • Network Transformers • Constant Current Transformers • Capacitors • Transformers For Electronics

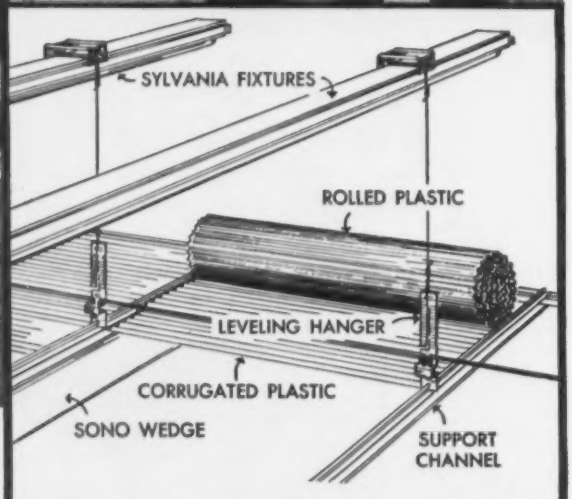
AND TORONTO, ONT., CANADA • SALES OFFICES IN ALL PRINCIPAL CITIES

Another Sylvania Achievement

SYLVAN-AIRE

A three-way functional treatment of beauty—sight—sound





Showing details of Sylvania's new functional Sylvan-Aire. For ease and economy of installation, wire supports shown here are attached to lighting fixtures instead of structural ceiling.

Adaptable! Easily Installed! Economical!

You never saw a more fascinating or a more functional system of sight and sound control! It's engineered by Sylvania to serve 3 ways!

1st ...it has the beauty and character of continuous corrugated white plastic.

2nd ...it is a source of soft, eye-pleasing over-all lighting.

3rd ...its inconspicuous V-shaped "Sono-Wedges," lined with thick glass-fiber pads, deaden noise...reduce distracting sound to comfortable levels.

In addition, the corrugated form of the plastic permits air to circulate along the supporting channels. Thus *air-conditioning* also can be effectively introduced.

Flexible in Design!

Sylvan-Aire's light weight and flexibility of design permit it to be readily and economically installed in any conference room, office or working area. Be sure to remind your electrical contractor friends about this latest Sylvania achievement. For full details write today to Dept. 4X-2814 at Sylvania.

SYLVANIA

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Increase conductivity and protect your connections with BLACKBURN's *Contax*

Available in ½ lb. tubes and pint, quart and gallon cans.

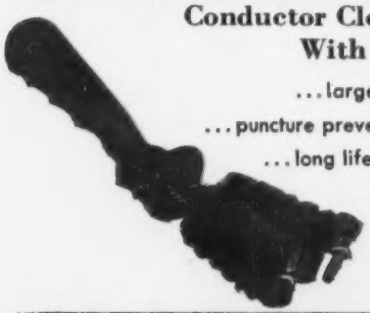
Metallic particles in Contax break through oxide films, lowering interstrand and joint resistance. Low resistance connections remain cooler, and last longer.

High temperature stability, ASTM drop point of 380° F, insures lasting performance under severe operating conditions.

Contax is weather-resistant and seals out air and moisture to eliminate corrosion.

Contax is stable—will hold metallic particles in suspension indefinitely.

Extra heavy duty lead tube will not crack with flexing.



Conductor Cleaning Brush With Glove Guard

- ...large easy-grip handle
- ...puncture preventing glove guard
- ...long life rotatable brushes
- ...high dielectric durable coating

For Best Long Life Performance:

Brush-Clean Conductors
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Servicing the Power needs of the world's largest shopping center

Northland—gigantic, ultra-modern shopping center of the J. L. Hudson Company—offers suburban Detroit the utmost in shopping convenience. The Hudson Building, hub of the Center, is surrounded by five tenant structures, housing approximately 80 different stores.

An extensive electrical system, capable of supplying electricity for some 25,000 homes, brings Northland to life. From primary power to ultimate use, this system represents an outstanding example of commercial planning and foresight. I-T-E Unit Substations—channeling power throughout this shopping empire—are strategically located to provide maximum protection, control, and continuity of service.

Only the finest has been installed at Northland. Electrical distribution equipment—of fundamental importance—must be rugged and dependable to service such demanding power needs.

at Detroit's

NORTHLAND PROJECT

vital energy for a shopping wonderland
supplied by I-T-E dry-type, double-ended Unit Substations

Eleven I-T-E metal-enclosed Unit Substations, rated 1500 and 2000 kva, service the Center's immense lighting and power requirements. And to assure service continuity, Northland's electrical system features I-T-E Selective Tripping devices on the circuit breakers, which *isolate* system faults by interrupting only the circuit nearest the fault.

From the start, important engineering aid was given Northland by I-T-E application engineers. Thanks to this close cooperation, power distribution equipment was on hand *when needed* to fit right in with tight construction schedules.

I-T-E is proud of its place as a *major* contributor of quality power distribution equipment for the "world's largest shopping center."

AT NORTHLAND—

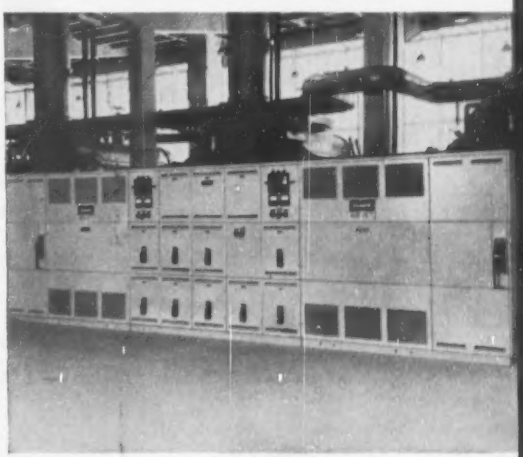
I-T-E Substations service:

interior lighting	**escalators**
exterior lighting	**pumps & blowers**
display lighting	**air conditioning**
elevators	**compressors**
conveyors	**refrigeration**

For details contact the I-T-E field office nearest you. Look in your classified directory under "Electric Equipment."

I-T-E UNIT SUBSTATIONS
service all interior lighting needs of the Center.

I-T-E UNIT SUBSTATIONS
installed in basement of Hudson Building for 4800—120/208 volt lighting distribution.



I-T-E UNIT SUBSTATION
installed in Utility House for 4800—480 volt power distribution.

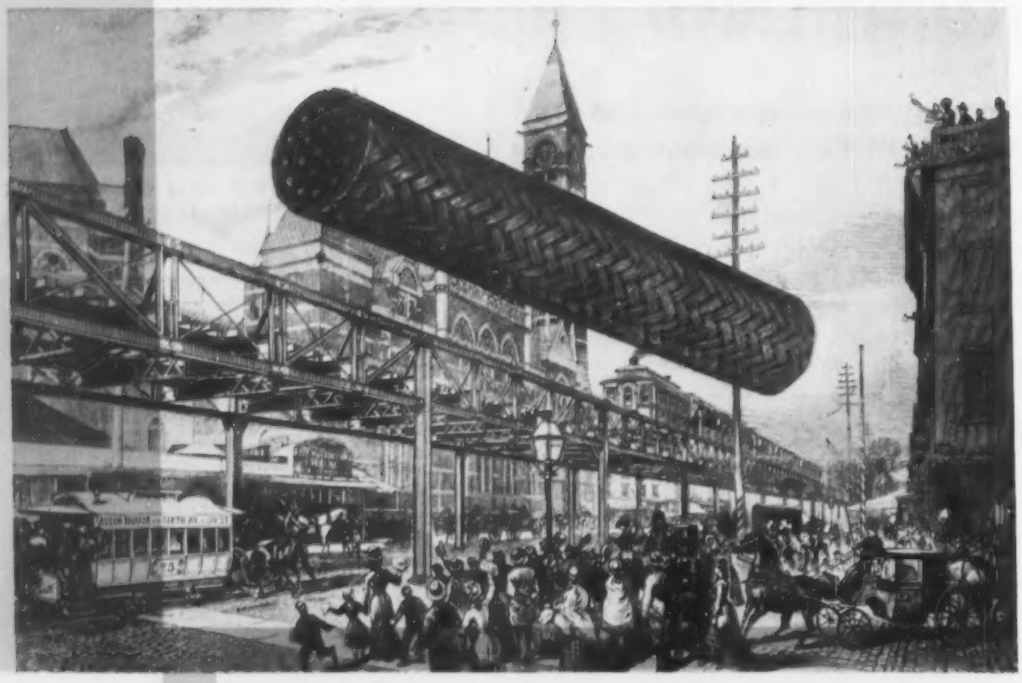
THE SYMBOL OF QUALITY SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STREETS, PHILADELPHIA 30, PA.

UNIT SUBSTATIONS

Kerite cables aided in the development of New York's rapid transit. Pictured is the first train on the Gilbert Elevated Railroad passing through 6th Avenue, near Jefferson Market Court, April 28, 1878.



DEPENDABILITY

The Kerite Company has been identified with industrial progress in this country for the past century. Poised on the threshold of another century, Kerite remains humbly dedicated to offering the best in quality and service.

The value and service life of a product can be no greater than the integrity and craftsmanship of its maker.

KERITE CABLE

THE KERITE COMPANY—30 Church St., New York 7, N. Y.
Offices also at 122 S. Michigan Ave., Chicago; 582 Market St., San Francisco; 3901 San Fernando Rd., Glendale 4, Calif.; 31 St. James Ave., Boston

The Future Distribution Systems

Distribution system planning is this year's most important subject. Electrical system loads have doubled in the last seven years, and residential use of energy has tripled. Facing a continuation of this rapid growth, particularly in the fringe areas, utilities are looking for the most feasible and economical plan of distribution. The load characteristics of these new areas, which will often be made up of all-electric homes having electric heating and cooling, will create many new problems.

In the past few years, we have observed the trends toward higher distribution voltages and larger substations and distribution transformers. We have noted many studies of distribution system design in the area of networks and other special systems. Such studies have often lacked full consideration for the growth that is still ahead.

So closely related are the many facets of distribution that proper evaluation of them cannot be made without a comprehensive study. This has been proposed to several association committees. They have turned down the offer because studies of distribution in its entirety become lost among its complexities. Understanding the difficulties of the task and in complete sympathy with the various association committees, Electrical World determined to take over this task as a contribution to the industry.

When this decision was made last December, the basic problem was to find a workable approach. The technical editors finally agreed that:

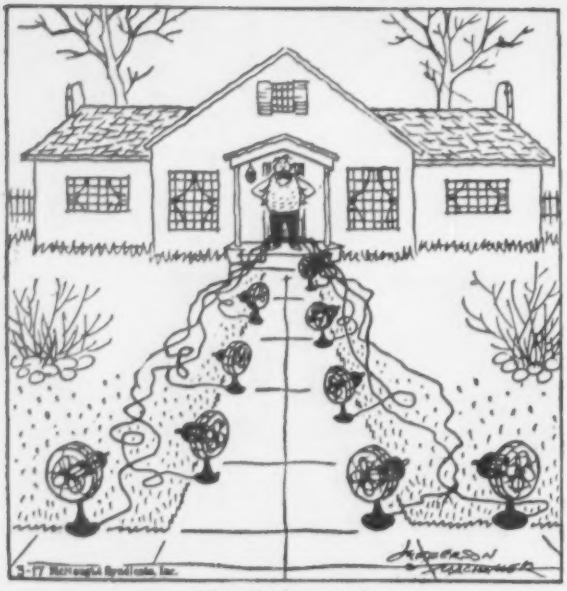
1. Where loads double in ten years or less, systems rapidly assume the form of current design practices.

2. These, together with reasonable predictions of improvements, mold the system that will provide tomorrow's distribution.

With this problem settled, the editors went to work. They visited personally about 100 utilities and questioned their engineering planners. From these men much valuable information has been collected. That published in this issue presents the trends disclosed by the first 62 interviews. Coverage is from coast to coast and border to border. There is little doubt that these are the trends of distribution throughout the industry.

But the survey is still going on. It is being pushed into those sections which could not be covered in the opening drive. When this phase is completed, another and more detailed report will be published.

We believe that the preliminary report contained in this issue along with the later roundup will provide much useful data. In fact it should be a guide for your plans for the distribution system of tomorrow.



"Now—let it snow! !"

Prevention Better Than Cure

Maybe Machamer had a practical idea without realizing it when he drew this cartoon. Maybe it would be better to prevent snow from settling on the sidewalk than to melt it off after it is impacted there.

This thought comes to mind in connection with an application of the Wisconsin Electric Power Co for a special residential rate applicable to customers using electricity for, among other things, melting snow off their sidewalks.

Nature uses the movement of air—wind—to pile up drifts of snow for the embarrassment of mankind. Why should not mankind embarrass nature by turning the tables and drifting snow out of mankind's way?

It would appear to be a better load for the utility—certainly one of much higher load factor—this job of blowing away the snowflakes as they fall instead of melting a layer of snow against the resistance of sub-freezing temperatures.

Here is a possibly promising avenue of applied research.

Boilers May Change Character

Boilers have been in a state of change for several years. Current developments indicate that even more pronounced changes are just ahead. Many of the later advances were related to the effort to improve the combustion performance of the boiler furnace. Special effort was made to render the gases turbulent and at the same time capitalize on the heat abstractable by dependence on the radiant properties of the mass. The volume of the combustion chamber became the index of aggregate heat release.

But with steam temperature steadily rising along with increased demand for Btu allocation to the reheat function, there were slagging troubles unless design was aimed at keeping the exit temperatures below the ash slagging point. Realization of this need swung attention toward the cooling function of the boiler surfaces and somewhat away from the earlier combustion-volume objectives.

Spurt in the trend toward much higher steam pressures is certain to inject several new influences into boiler design. The principal factor is, of course, the fact that above 3,217 psi the density of the steam is so near that of the water that circulation and separation can be problems. Continental European practice has developed considerable experience with forced-circulation boilers of the La Mont, Velox, and Loeffler types and with forced-flow units of the Benson and Sulzer types. Some of this experience has been acquired through test operation in the critical pressure region at 3,217 psi. What will be the trend here? It will depend on steam-water separation, tube and turbine deposits, feed treatment, simplicity, and economics.

In either area vertical height is no longer a *sine qua non* to provide thermal head for natural circulation. It can very well be, therefore, that the boiler will take on a horizontal pattern rather than a vertical one. If that proves feasible we may see power plants built in ranch-house style instead of skyscrapers. Further, the boiler, turbine-generator, and condenser can be envisioned as parallel to one another and more or less at a common level. That will, of course, happen only if the inescapable auxiliaries and cycle components can be distributed advantageously and effectively in the fewer levels such a revolutionary plant would afford.

Lighting Lament

Only 7% adequate is the average condition of street lighting in our country, the most highly electrified in the world. This estimate is based on comparison with the recommended minimums set up by the Illuminating Engineering Society and adopted by the American Standards Association. It is the collective judgment of men whose life work is street lighting.

Why does this condition exist? Why is it that only a few city governments, only a few electric utilities are making any real effort to correct it?

Reasons they say are good are offered by most municipalities and utilities in answer to these questions. But in the light of the indisputable facts of modern street lighting these "good" reasons pale into mere excuses for apathy and inaction. Here are three of the indisputable facts:

1. Modern adequate street lighting greatly reduces night time traffic accidents. Car deaths in 22 places where lighting was improved dropped to 66 in the year after as compared with 205 in the year before—a saving of 139 lives.

2. Light chases crime. That street crimes decline as street light increases is proved by police records.

3. Modernized street lighting is a business stimulator for merchants and a protector of property values in the competition between shopping areas.

These and other facts in detailed evidence of the benefits from up-to-date street lighting are easily available to anyone who is in the least interested. The National Street and Traffic Safety Lighting Bureau, 1410 Terminal Tower, Cleveland 13, Ohio, will oblige with a deluge of such evidence at the slightest indication of interest. But apparently there is not much interest in improved street lighting as a means for saving lives, reducing crime, and stimulating business. This is why the words, "Lighting Lament," head this editorial.

THE ELECTRICAL WEEK

The Issue's News Highlights . . . Interior Secretary Douglas McKay announces support for John Day project in major policy speech at Portland, Ore.

Gibbs & Hill denies it will act as consultant to unnamed syndicate interested in building steam plant at Fulton, Tenn., to serve AEC installations.

Walker Cisler urges licensing procedure changes in proposed amendments to Atomic Energy Act.

Five Pacific Northwest power companies have signed an agreement with Atomic Energy Commission to study the feasibility of a nuclear reactor as a source of power for the region. The same companies, Washington Water Power, Pacific P&L, Montana Power, Portland General Electric, and Mountain States Power, also have incorporated to build hydro plants.

The United States should set up an atomic energy plant in Asia dedicated to peace, Supreme Court Justice William O. Douglas said in an address in New York. "We were the ones who first scorched a city with the bomb—and that city was in Asia. Let us, in humility, take to Asia an atomic plant dedicated to peace. It will speak more eloquently than any propaganda of the devotion of America to the interests of the common man, whatever may be his creed or color."

AEC Chairman Lewis L. Strauss told a convocation at the University of Rhode Island that electrical production of atomic energy should be "close to the commercially competitive goal" by 1959 or 1960.

Portland General Electric Co announced it will appeal to the U. S. Supreme Court a Circuit Court of Appeals denial of the Oregon utility's petition for a rehearing on the Pelton Dam case. The lower court had invalidated an FPC license granted PGE to build the dam on the Deschutes River. State of Oregon, through its fish and game commissions, had appealed the FPC action.

Rhode Island's Governor Roberts vetoed a bill he had sponsored to compel utilities to pay 45% of the costs of the State Public Utilities Division. The bill had been amended against his wishes to strip the director of the State Department of Business Regulation, of which the division is a part, of control over utilities.

Atomic bombs would have been dropped by now on the U. S. if it were not for TVA's ability to produce an extraordinary amount of power for production of our own atomic bombs, Mayor George R. Dempster of Knoxville, Tenn., said in a debate on the Authority with C. Hamilton Moses, chairman of the board of Arkansas P&L. Dempster is president of Citizens for TVA, Inc. In rebuttal, Moses asserted TVA does not pay local, state, or federal taxes in the manner of private utilities and, if it did, would show a deficit.

Off the Washington Wire . . . Tennessee Valley area senators are threatening a speech a week until the White House clarifies its stand on expansion of TVA power supply. Indications are that the public-private power fight in Congress this year will be fought on TVA funds.

Appropriations bills, which pretty well set the pace for Congressional activity, are nearing final action in Senate committees. The Interior funds bill, carrying money for such agencies as Reclamation Bureau, Bonneville Power Administration, Sepa, and SPA was in its last round of hearings. Agriculture bill, carrying funds for REA, was ready to be marked up. A Senate subcommittee was already working on the final version of the Army Corps of Engineers bill carrying additional money for a number of big multipurpose projects.

FPC has sent to the Senate recommendations which would require the government to pay for upstream benefits to federal hydro projects where those benefits are provided by electric companies or other nonfederal agencies.

Vermont Electric Cooperative, Inc, of Johnson, Vt., asked for a preliminary permit for a 10,000-hp hydro project on the Lamoille River in Franklin County. The site, however, is owned by Central Vermont Public Service Corp, from which the co-op takes all its power.

New York City's Transit Authority rejected the $8-million offer of Consolidated Edison Co to purchase the city-owned Kent Avenue plant in Brooklyn, which supplies power to BMT subway lines.

New Jersey P&L and IBEW-AFL agreed to a 5% wage increase retroactive to April 1. New contract expires April 30, 1955 . . . Western Massachusetts Electric and IBEW agreed on an increase of 3% with a minimum of $2 a week retroactive to May 1. This will be followed next Jan. 1 by another raise of 2% with a minimum of $1.60. Contract life is two years.

Oklahoma G&E is sponsoring the first regularly scheduled local color television program in the United States. The show, "Cook's Book," is telecast five days a week over Station WKY-TV, Oklahoma City.

Consumers Power Co and UWUA-CIO agreed to accept a report by Michigan Governor Williams' Fact Finding Committee granting 6¢, 7¢ and 8¢ hourly increases (EW, May 10, p 5).

General Electric Credit Corp has made available a financing plan to handle adequate house wiring independent of any appliance purchase by the customer. The company previously had included the cost of wiring installations in its appliance contracts.

McKay Assures Northwest on Power

Secretary announces support for John Day project, says BPA rates will not be raised for two years, defends Administration's 'partnership' concept

Vigorously denying that the Administration opposed any "new starts" in construction of federal power projects in the Pacific Northwest, Interior Secretary McKay last week called for construction of John Day Dam on the Columbia River.

The dam would be situated between The Dalles and McNary Dams. Power facilities would have a generating capacity of 900,000 kw. The development has been under study as a possible federal-local partnership project.

Answer to Critics . . . McKay's major policy speech at Portland, May 10, was intended as an answer to critics of Eisenhower's "partnership" concept and Administration power policy.

The Interior Secretary explained that the Eisenhower Administration inherited a "no new starts" policy from the Truman Administration which was issued at the outset of the hostilities in Korea. But now, he said, "We are ready to go ahead with a new start."

The former Oregon governor also pointed out that Interior and the Army were pushing for an early start on Libby Dam on the Kootenai River in Montana.

BPA Rates . . . McKay also took the occasion to reassure the Pacific Northwest that there will be no increase in Bonneville Power Administration rates "for at least another two years" and then only if required because of higher cost of new federal dams rising on the Columbia River.

BPA rates are subject to review December, 1954, under the five-year adjustment clause in the Bonneville Act. McKay said that after two years he thought the new rate would be "something less than a base rate of $22.50."

The Interior Secretary emphasized the entire rate structure and cost factors have been under close scrutiny since he took office and had been placed on "sound business principles."

Defends Partnership Concept . . . McKay defended the "partnership" concept of power development, noting the number of applications for sites by public agencies and private companies before the Federal Power Commission.

McKay referred to Eisenhower's "partnership" pronouncement in Seattle in 1952 and added "if local participation in power development could be stimulated it was obvious that Congress would be more amenable to appropriating funds for projects of necessarily exclusive federal construction."

Answering charges of a giveaway, McKay declared, "In the field of private development, the sites sought for these projects, financed by private capital, do not carry with them any complete title forever. Under the license of FPC, the federal government can step in at any time and take the project over by condemnation."

McKay referred to the offer of California to buy Central Valley Project and noted this was originally proposed by California and taken over by the federal government. But to keep the record straight, McKay said "We told them last year that we will listen to their proposal. But we are not trying to sell that project."

Dams Not for Sale . . . The Secretary said further there are no "for sale" signs on the federal dams of the nation. In this connection he declared: "We are trying to develop more electric power. To sell these existing projects, whether to a public agency or a private company, would not add one kilowatt to this region or any other region."

The ex-governor also explained that this withdrawal of Interior objections to Idaho Power Co's plan for Snake River development followed the Roanoke Rapids decision that FPC held authority in such matters. Commenting on the Hells Canyon hearing, McKay had this to say: "My only concern is that a decision be reached without undue delay. The Northwest needs kilowatts and any actions that are only for the purpose of delaying a decision are, in my opinion, simply a disservice to this region."

In this connection he said critics of his policies had been loose in handling information and some of the criticism was based "on deliberate misinformation." The Secretary's Scot dander was stirred up and finding he had a few seconds of time left, he departed from his text and declared: "I am sick and tired of hearing 'McKay has forgotten he is from the West.' "

McKay's speech was delivered just nine days before Oregon's primary election on May 21. In the election Gov Paul Paterson is battling GOP Secretary of State Earl T. Newbry for the gubernatorial nomination and Sen Guy Cordon is opposed by State Sen Richard L. Neuberger for the senatorial nomination. Both Newbry and Neuberger have been outspoken critics of Administration power policy.

SECRETARY McKAY (left) conferred with BPA Administrator William A. Pearl at Portland, Ore., on his recent trip to Pacific Northwest

Maine Hydro Project Nearing Completion

Central Maine Power Co's Indian Pond development on the Upper Kennebec River, with 45,000-kw initial and 75,000-kw ultimate capacity, is making scheduled construction headway. First unit is expected to go on the line late this year with a second unit to be installed in 1955. Developed head will be 150 ft. The dam is now complete except for headworks installation.

High Hells Canyon Dam Supported at Hearings

Advocates of federal Hells Canyon power development on the Snake River in Idaho took the offensive as hearings resumed before the Federal Power Commission in Washington last week.

C. Girard Davidson, former Assistant Interior Secretary and counsel for the National Hells Canyon Association, fired the opening blasts as the new round of hearings got underway. He charged that the Idaho Power Co bid for a three-dam development of the disputed site adheres to "the old-fashioned concept of abuse of the people's resources for private gain . . ."

Davidson called on FPC "to recommend to the Congress that the United States itself develop the Middle Snake in accordance with the coordinated comprehensive (high dam) plan."

Davidson's lead-off statement marked the end of a two-month recess in the FPC hearings which began in July of last year. Company and government witnesses were examined at previous sessions.

In outlining the National Hells Canyon Association case, Davidson told reporters that some ten public power witnesses were prepared to present the high dam case. Most widely known of these are former Reclamation Commissioner Michael Straus and former Federal Power Commission Chairman Leland Olds. Davidson, Straus, and Olds all served under previous Democratic Administrations.

Other witnesses scheduled to appear on behalf of the high federal dam are representatives of Washington State PUD's, the Oregon Grange, Idaho rural electrical co-ops, Washington State Federation of Labor, marketing and supply co-ops in Hells Canyon area, and Bonneville Power Administration.

Following the presentation of the National Hells Canyon Association, FPC staff engineers and other FPC witnesses are scheduled to testify.

TVA Area Plant . . .

. . . will not be built by Gibbs & Hill, Inc, its president David Sloan announces

One of the nation's top engineering firms has announced emphatically it will not build a $100-million power plant at Fulton, Tenn., to supply power for the Atomic Energy Commission installation at Paducah, Ky. (EW, May 10, p 8).

This latest offer that the federal government received came from a syndicate whose attorney is Lucius E. Burch, Jr, of Memphis, Tenn. The first offer to supply the AEC installation came from Middle South Utilities, Inc, and Southern Co sometime ago.

A letter dated May 6 from David Sloan, president of Gibbs & Hill, Inc, informed Walter Von Tresckow, 400 East 52nd St, N. Y., spokesman for a group of private investors backing the proposed plant at Fulton, that "we are not participating in any activities detrimental to the private utility industry in the country."

Sloan also said in the letter: "In our original discussions, we had no knowledge of the fact that any private utilities were interested in the construction and operation of a generating station in the Tennessee Valley area for the Atomic Energy Commission."

Von Tresckow is an industrial and financial consultant and was formerly with the Hanover Bank & Trust Co in New York. When an editor of EW checked with the office of Von Tresckow, he was told the consultant was "unavailable for about two weeks on doctor's orders."

AEC Meeting Cancelled . . . Burch, retained by the syndicate members as their representative in Tennessee, said that the departure of Gibbs & Hill had forced cancellation of a May 11 appointment with AEC officials at

which the private capital group hoped to discuss AEC's demand for a cancellation clause in its contract with the syndicate. He stated that he was notified by the AEC that it cannot consider a contract unless it is given the right to cancel out at any time.

"This is the AEC's interpretation of the extent of its authority," said Burch. "Apparently new authority from Congress would be needed to permit AEC to make a contact with a firm long-term commitment."

"If a contract with such a cancellation clause was signed," said Burch, "it, of course, would be virtually impossible to sell bonds on the project." He added that new inquiries would be made to determine whether a long-term contract could be made jointly with the AEC and the Tennessee Valley Authority.

Burch has declined to name the syndicate members except to say it is made up of firms qualified to build and operate the plant. He said that "no southern outfits are involved in the proposed Fulton plant project."

On Capitol Hill, a Senate Appropriations subcommittee last week was marking up the TVA money for the next fiscal year. As far as could be determined, this bill carries no money for new TVA generation projects. Senators from the TVA area doubt that the Senate will go beyond Budget Bureau request of $141.9 million for the agency which would enable it to carry forward construction already underway.

Middle South Proposal Being Considered . . . Bureau of the Budget and AEC have been considering for weeks a proposal by Middle South Utilities, Inc, and the Southern Co to build a 600,000-kw steam plant west of Memphis to feed into the TVA system (EW, April 26, p 7).

Senators Estes Kefauver, Lister Hill, and Albert Gore, all Democrats from the TVA area, are preparing for an all-out fight for the TVA power expansion when the TVA appropriations bill reaches the floor for debate. In lieu of direct appropriations for expansion, they appear ready to push the offer of the unnamed syndicate.

In view of the present legislative situation, it appears that any White House move to increase TVA appropriations would have to be taken separately from the TVA funds bill which is nearing Senate consideration.

Nuclear Power Bill Endorsed

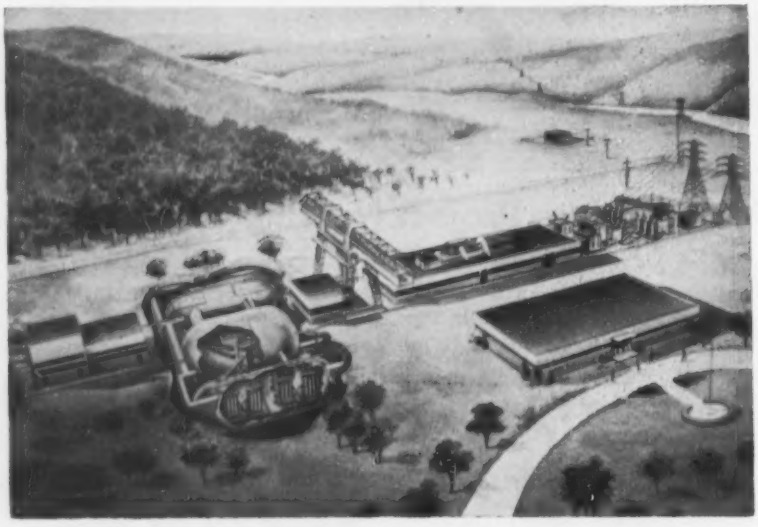
Walker Cisler, at Joint Committee hearing, says proposal is 'step in right direction' toward private development

Bill to permit industrial development of atomic power received general endorsement of electric utility and other industry spokesmen as hearings began in Washington last week.

Chairman W. Sterling Cole of the Joint Congressional Atomic Energy Committee said he expected action on such legislation during the current session of Congress. At the same time he described the current series of hearings as preliminary to revision of the Joint Committee bill. Following further committee work on the bill, another brief series of hearings will be held before a final version of the bill is presented to Congress.

Cisler Testifies . . . First electric company witness was Walker L. Cisler, president of Detroit Edison Co, who described the present bill as a "definite step in the direction to encourage and permit private industry" to develop peacetime atomic power.

Cisler appeared in behalf of the Detroit Edison-Dow Chemical nuclear study group with which 26 electric



Reactor Goes Underground in A-Station

Artist's sketch of nuclear power plant, being undertaken as a joint project by Duquesne Light Co and Atomic Energy Commission, shows location of atomic reactor underground in concrete and steel structures. This portion of the plant will be constructed by Westinghouse Electric Corp. Duquesne Light will build the turbine generator portion and will operate the entire 60,000-kw plant.

Plant components depicted in sketch are, from the left: building for fuel handling, atomic reactor and heat exchangers, maintenance building and overhead traveling crane, turbogenerator building, switchyard containing transformers and circuit breakers, and transmission lines. In the right foreground is a building containing shop and administrative facilities.

Large central underground structure houses the reactor itself which is located within the vertical, cylindrical container which represents the pressure vessel. Water under pressure is pumped through this vessel. It is heated and is pumped to four heat exchangers, two of which are visible in the cutaway foreground. The other two are in the horizontal cylindrical structure to the rear. Heat from this pressurized superheated water converts other water in the heat exchangers to steam which is piped to the turbogenerator.

power companies and industrial firms are associated.

He objected to some provisions of the bill, however. These were:

- Perpetual federal ownership of fuel materials.
- Licensing procedures for permitting non-federal development and operation of atomic power plants.

Cisler said the provision of the bill which would retain federal title to all nuclear fuel materials "poses difficult problems in financing and in free enterprise under government subsidy for industry." He told the committee that lack of ownership of atomic fuel would make financing costly if not impossible, since the government could withdraw fuel at any time.

Any nuclear material produced as a by-product of atomic power, he said, should become the property of the plant owner subject to negotiated sale to the government. Under the bill this by-product material would become federal property.

Asks Licensing Change . . . Cisler, called the licensing provisions in the bill "confusing, vague and perhaps even unworkable." He argued that the proposed law does not establish standards or minimum requirements for applicants. Further, he said, "an unreasonable number of special licenses is required for an integrated power facility."

He referred to licenses which would be required for each nuclear power plant, for operators of such plants, and for leasing arrangements of the nuclear fuel employed in such plants.

Instead of the multiple licenses, permits and lease agreements, the Detroit Edison executive recommended that a single license be authorized to cover all integrated operations.

Cisler also took exception to the provision of the bill which appears to require Congressional review of each license issued. "The potential complications (of this provision)," said Cisler, "are beyond imagination."

Restricted Data . . . Jerome D. Luntz, editor of McGraw-Hill's Nucleonics magazine, criticized provisions of the bill pertaining to dissemination of information. He hit particularly at those provisions which would levy heavy fines on persons who might pass restricted data to non-cleared persons and on the person who receives such information if he disclosed it. No showing of willful intent to injure the nation is required in connection with these penalties.

Luntz told the committee these provisions will tend to make scientists and publishers over-conservative in discharging their obligation to "provide that free interchange of ideas and criticism which is essential to scientific progress."

Other witnesses scheduled to appear included Alfred Iddles, Babcock & Wilcox Co; Samuel B. Morris, American Public Power Association; Edgar H. Dixon, Edison Electric Institute; John Menke, Nuclear Development Associates; Francis K. McCune, General Electric Co; Carl Cohen, Walter Kidde Nuclear Laboratories, Inc; and Clyde T. Ellis, National Rural Electric Co-operative Association.

Falcon Dam Power Bill Has Preference Clause

If a House Interior subcommittee has its way, a restatement of continuing preference for public bodies will be written into a relatively trivial power bill in a move to avoid charges that the Administration is attempting to curtail public preference for federally produced power.

HR 8328, providing for marketing and distributing of power from Falcon Dam on the Rio Grande River, is necessary because the dam is the product of a treaty between the United States and Mexico.

To meet charges by rural co-op groups that the Administration is preparing to limit federal customers to the power they request when it first becomes available from a new project, the committee is doing two things, in the bill due to get full committee approval May 18:

1. Restating the language of the Flood Control Act of 1944 which has been interpreted to provide for continuing preference for public customers.

2. Preparing to amend the bill to include language from the Reclamation Act of 1939 considered to underline public preference even more sharply.

The bill will further provide that any proposed contract for power from the dam must be submitted to the House Interior Committee during 60 legislative days after transmitted by Secretary of Interior.

Power from Falcon Dam, according to the subcommittee proposal, would be divided into three types: preference-type; surplus type, to be leased long-term to non-preference customers; and a reserve block to be leased short-term to non-preference customers and subject to recapture within, say, three to four years.

Senate Public Works Committee also has a companion bill under study and expects to report it out momentarily. It would use the language of the 1944 Flood Control Act to underline the continuing preference concept of power marketing.

POWER BRIEFS FROM THE NEWS

- Georgia Power Co has announced it will go ahead with purchase of a site at Hobbs Island on the Tennessee River 15 miles from Huntsville for possible construction of a power plant. Selection of plant site, however, depends upon outcome of current drilling tests. The Hobbs Island tract is one of several acquired by the company, the others being in Georgia.
- Colorado Association of REA Cooperatives has filed a statement with President Eisenhower's task force on power water resources protesting against private utility offers to build distribution lines for the $1-billion Upper Colorado River and $172-million Frying Pan-Arkansas projects. The association said transmission lines should be built by the government to eliminate "profit middlemen" in the sale of public power.
- National Association of Manufacturers has published a pamphlet entitled "Free the Atom." The booklet contains the views of leading atomic authorities on giving industry a larger role in atomic progress. The group advocates the Atomic Energy Act should be amended to permit industrial enterprise to develop nuclear energy for peacetime needs.
- Gulf States Utilities Co has paid $5,000 for a 120-day option to buy 179 acres near Port Arthur, Tex., as a possible site for a power plant.

Missouri Basin Contracts

Reclamation is negotiating pacts for sale of power in Western Division and western area of Eastern Division

Bureau of Reclamation has started negotiating contracts with preference customers for sale of power from Missouri River Basin projects.

Green light for the negotiations came late in March after months of discussions over new marketing criteria, rates, allocation of power and the Republican power policy. Regional offices will handle the negotiations subject to final approval by Interior Department in Washington.

For the time being the negotiations will be confined to sale of power in the Western Division and in the western area of the Eastern Division. Because demands far outstrip supply in the remaining area of the Eastern Division, Reclamation must still work out a final allocation plan for federal power in that area.

Western Division . . . In the Western Division, Reclamation has approximately 124,000 kw of firm power available for additional commitment. With this, the bureau believes it will be possible to supply all customers under existing contracts through 1956 and all preference customers through 1957 and midway into 1958.

Power for this area will come from the following Reclamation projects: Shoshone, Heart Mountain, Pilot Butte, Boysen, Kortes, Guernsey, Lingle, and Seminoe in Wyoming, and Green Mountain, Marys Lake, Estes, Pole Hill, and Flatiron in Colorado.

Western Division marketing area covers Wyoming east of the Continental Divide, Colorado, and western Nebraska.

Needs Restudied . . . Preference and non-preference customers applied for an additional 197,738 kw in that area for which only 124,000 kw of new power is available. However, studies and recommendations by the bureau indicated only about 106,180 kw would be required through 1957. The remaining 17,820 will likely be contracted for sale to non-preference customers along with the 26,440 kw allocated to this type of customers.

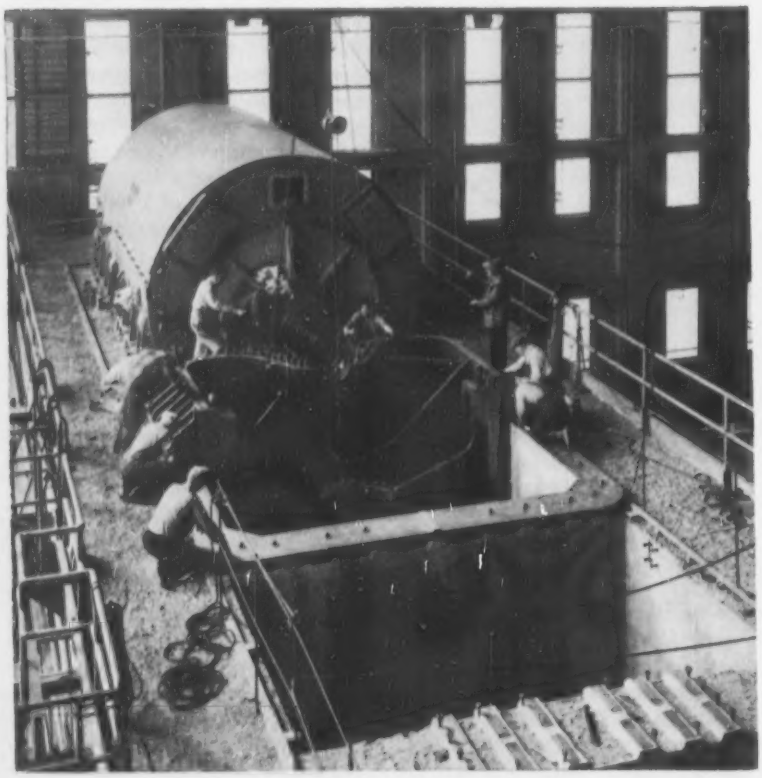
The picture is even brighter in the western area of the Eastern Division. In that area present commitments, plus applications for future supply, amount to only 65,010 kw as against approximately 94,000 kw that will be available from the Fort Peck and Canyon Ferry power plants.

It is the eastern area of the Eastern Division where Reclamation power marketing is running into trouble. This area is to be served by the Garrison, Fort Randall, and Gavins Point power plants. With a small amount of power which will be transmitted from the western area, there will be a total of 531,000 kw of firm marketable power in this area by 1958. Existing commitments already involve 341,125 kw, leaving only 190,000 kw for future commitment.

Preference customers alone have applied for 402,315 kw of additional power—far more than will actually be available. At best, Reclamation figures it will be able to meet no more than 45% of preference customer requirements by 1958.

Reclamation officials now estimate it will be June before a final analysis is made and allocation of power is announced for the eastern area of the Eastern Division.

Contracts now being negotiated in the other areas of the basin are in line with the Missouri Basin marketing criteria announced by Interior Department last October, and modified in December. At a series of meetings in Denver, Colo; Sioux Falls, S. D.; Bismarck, N. D.; Billings, Mont.; and other major cities in the marketing area, Interior officials discussed the criteria with customers.



Workmen Assemble Boston Edison Unit

Riggers are shown placing casing of the turbine low pressure section on its foundation as work progresses on installation of a third 81,250-kw unit at Boston Edison Co's Edgar Station. Permanent assembly of the generator has been completed. The 1,450-psi, 1,000-F reheat steam unit is scheduled to go into operation this summer.

Dominant mood at APPA meeting is concern over changing policy in Washington, attacks by private power interests as . . .

SEN WARREN MAGNUSON

UNDER SECRETARY RALPH TUDOR

Public Power Is Warned of Perils Ahead

Public power representatives attending the American Public Power Association annual meeting held May 4-6 at Chicago were told repeatedly that private power companies were plotting the annihilation of public power.

The lead-off speaker, Sen Warren G. Magnuson (D-Wash.), announced flatly that the private power interests had declared war on public power and that public power was fighting for its very existence.

REP ROBERT JONES, JR

Allied with the private power interests, he contended, were high members of the present Administration.

The Tactics . . . Magnuson listed the tactics being used against public power as these:

1. Cutting appropriations on presently authorized generation and transmission projects to delay their completion and failure to vote funds for new projects.

2. Driving up rates of public power agencies.

3. Filing on power sites by private companies, even though in some cases full development is not planned, to prevent public development of rivers.

4. Sowing confusion and dividing ranks of public power. In this connection Magnuson cited the Administration's "partnership" policy as an attempt to confuse and divide public power bodies.

5. Poisoning people's minds against public power through an advertising "program of vilification" with "creeping socialism" as its theme song.

Magnuson assured the delegates to the public power conference that they too had some friends in Congress who were fighting for the continuance and growth of public power. He said the battle was not a public vs private power fight since both groups were needed to give the country the cheap kilowatts it requires.

Goal Is More Power . . . At a later session, Rep Robert Jones, Jr, (D-Ala.) echoed many of the thoughts expressed by Magnuson. Declaring that the present rate of construction does not assure the nation of an adequate supply of power for the future, he emphasized that the country's security demanded more power "irrespective of ownership."

Jones charged that private utilities have followed market demand for power in adding new capacity whereas public power systems have established "an enviable record for anticipating future energy requirements."

But in trying to carry out such a policy public power must hurdle obstacles thrown in its way by the private utilities, whom Jones characterized as "cunning plotters . . . seeking to destroy public power agencies and systems." To do this, he said, they are carrying on a campaign to discredit public utility institutions and to

this end have employed "half truths and ugly deceitful rumors."

The "enormous truth," said the Alabaman, is that electric service is a public service no matter who owns or operates the power facilities. He advocated a policy which would foster public and private power and hold both accountable as a public service.

Far-Reaching Attack . . . Jones interpreted the attacks on Tennessee Valley Authority as a plan to kill public power in all parts of the nation. He said the objective of proposals for curbing TVA expansion and providing private power for federal installation and consumers in the valley was higher rates—for the purpose of wiping out the yardstick of TVA power.

Jones made a bitter attack on the "partnership" concept, claiming federal power programs such as TVA always had been a great partnership between the federal government and the people. New federal power program, he asserted, is a partnership between government and private utilities or more specifically Wall Street and other financial interests.

Interior's Position . . . Undersecretary of Interior Ralph Tudor presented the Administration's position.

The Interior official emphasized that federal public power, local public power, and private power were needed to meet the nation's power requirements. He said Interior believes the federal government "should and will continue to build and operate certain generating plants and transmission lines." But where local interests—public or private—are willing and able to do the job they should do so. Interior's policy, he said, is to support federal participation only where local interests cannot build the projects.

To critics who claim that these are empty words, Tudor pointed to the Upper Colorado River project which has the backing of the department.

The choice between public and private power is one for the people to make locally, the Interior aide insisted. "In these local discussions and arguments," said Tudor, "we shall wish both sides well and may the best side win."

Tudor defended the Administration's "partnership" principle claiming it had the advantages of lesser financial strain on the federal treasury and local control and ownership.

In a report to the membership, APPA Pres Carroll A. Oliver listed as setbacks to the public power program during the past year as omission of a preference clause in the license granted New York State Power Authority for developing St. Lawrence power and passage by the House of the private enterprise bill for development of Niagara power. But he noted public power groups had been more successful in gaining modification of Interior's Missouri Basin marketing criteria.

Grass Roots Movements . . . One of the most encouraging developments of the year was the growth of "grass roots" support for public power, said Oliver, citing organization of electric consumers groups around the country.

Noting the stepped up private utility campaign against public power, General Manager Alex Radin advised APPA against adopting similar tactics even if its budget would permit it. He declared: "It is unjust for the utilities to spend their ratepayers' money for such purposes, and it would be equally unjust—if not immoral—for us to do so."

Resolutions . . . Resolutions passed at the APPA annual meeting give further indication of the association's concern over policies of the federal government and private power interests. Among the 20 resolutions adopted unanimously were these which:

- Urged that legislation be enacted by Congress requiring FPC to include a preference clause in licenses granted public agencies and that New York State Power Authority grant preference to public agencies and co-ops in marketing St. Lawrence power.
- Urged Senate to amend Niagara power development bill to provide for public development with preference to public bodies in sale of power.
- Urged Senate to include in legislation regarding TVA a provision for installation of needed additional generating facilities.
- Condemned statements of General Electric Co and Westinghouse Electric Corp attacking public power agencies as damaging to local public agencies which are substantial customers of these companies.
- Declared the provisions of proposed amendments to the Atomic Energy Act are subversive to the public welfare and designed to serve individual private interests at expense of general welfare.

DR ALVIN WEINBERG

Atomic Power . . . APPA's position on the proposed revision of atomic energy legislation was revealed in more detail in a report to the convention by the chairman of its Atomic Power Policy Committee, Samuel B. Morris, general manager and chief engineer of Los Angeles Water and Power Department. He noted the proposed revision does not adequately provide against creation of a patent monopoly permitting only a limited number of companies to participate in an industrial atomic program.

Cheap Nuclear Power . . . Atomic energy also was the topic of one of the major non-political addresses delivered to the convention. In it Dr. Alvin Weinberg, director of Oak Ridge National Laboratory, called outlook for cheap nuclear power which add to the cost of the unit, very good.

He said that up to now most atomic power development has been concerned not with cheap power but with manufacture of fissionable material or compact power units for military use. Weinberg pointed out compactness has little relevance to the design of central station power plants.

Weinberg cited costs of conventional generating and electric equipment at about $90 per kw, with boiler costs adding another $70 per kw. He foresaw the possibility of building reactor systems to replace boilers for less than $70 per kw.

PURCHASING AGENTS and stores managers are shown enjoying lunch at the spring meeting of EEI Purchasing and Stores Committee

Putting a Profit in Purchasing and Stores

Cost cutting and money saving sparks discussion of purchasing and stores by Edison Electric Institute committee

"Purchasing and stores operations for profit" keynoted the Edison Electric Institute's Purchasing and Stores Committee meeting held in New York May 2-5.

To match a dollar saved in purchasing, it was pointed out, it is necessary to sell about $3 worth of energy, which considered on an annual return basis requires an investment of over $16.

To meet the challenge of establishing and maintaining high level efficiency in their operations, the purchasing agents and stores managers discussed a wide variety of cost cutting and money saving ideas.

Savings Reported . . . It was reported, for example, that by the use of a fleet of tractor-trailer vans one company had been able to effect an annual saving of over $38,000. In addition to this saving there was an additional saving in packing, tagging, postage on papers, and the return of scrap and salvage from field points which had little or no market. This same company returned to its vendors for credit before obsolescence materials valued at $14,125 as the result of a check on slowing items.

The regular review of items which show no activity for over one year permitted another company to reduce its inventory by $201,165. Another has shown an annual saving of $2,130 in inventory and handling charges by making arrangements with a local pole supplier to have him carry poles for their use in his stocks. This same company also enjoyed a saving of about $12,000 per year by having transformer vendors maintain a 90-day supply, again permitting a reduced inventory.

Stores Operation for Profit . . . Several companies reported breaking down bulk quantities to smaller issuing units and the assembly of kits for issue to operating departments.

In all cases, the emphasis was on speed in issuing material and rendering service.

On the subject of packaging, one company outlined a new practice which they estimate will save $15,000 annually in labor costs. This company uses large containers for shipment by vendors of hardware, insulators, cutouts, and similar material. Upon issue, the material is picked directly from these containers mounted in racks.

Modern Materials Handling . . . In discussing the problems and values underlying modern materials handling the value of coordinating stores, purchasing, vendor and user was given prime consideration.

The use of unit loads has produced clear cut savings. Ten foot crossarms strapped in units of 60 and loaded in a gondola car realized a $300 saving for one company on an order of 3,200 arms. This $300 saving, it was reported, represented only the direct labor savings resulting from the change in unloading methods from a "bucket brigade" type of operation to a new method of crane unloading. No attempt was made to evaluate savings realized in reduced time for inventory or increased use of storage.

Typical of the savings which can be gained were the reports by several companies that they were saving $75 to $100 of handling time on a load of brick by having vendors strap the loose brick to a pallet.

PUAA Makes Copy Awards

Results of oldest advertising contest announced at Boston. Thirty-first competition attracted over 2,000 entries

Winners of the 31st annual Better Copy Contest, conducted by the Public Utilities Advertising Association, were announced May 14 at the association's annual meeting at Boston. Winners received certificates.

The contest, which is the oldest such contest in existence, attracted more than 2,000 entries in 22 classifications. The judging of most classifications was done in the home city of the classification chairman. There were four judges for each group.

Companies competed in groups according to the number of customers served. Group A consisted of those with over 400,000 customers, Group C of those with less than 150,000 customers, Group B of those with between 150,000 and 400,000 customers.

Unless otherwise stated the companies listed in each group are winners of first, second, and third awards, respectively. Only awards won by electric or combination companies are listed.

Complete programs—A: Consolidated Edison Co of New York, New York State E&G Corp, Cleveland Electric Illuminating Co. B: Texas P&L Co, first, San Diego G&E Co, third. C: Hawaiian Electric Co, first.

Series of three to five newspaper ads on a public relations subject—A: Philadelphia Electric Co, first; Cincinnati G&E Co, second. B: Louisiana P&L Co, Mississippi P&L Co, Rochester G&E Co. C: St. Joseph L&P Co, third.

Single newspaper ad on any subject—A: Northern States Power Co, Consolidated Edison Co, Virginia E&P Co. B: Houston Lighting & Power Co, Narragansett Electric Co, Kentucky Utilities Co. C: Hawaiian Electric Co, first; Hartford Electric Light Co, second.

Employee magazines—A: Consolidated Edison Co, Detroit Edison Co, Philadelphia Electric Co. B: United Illuminating Co, Metropolitan Edison Co, Utah P&L Co. C: Hartford Electric Light Co, first; Hawaiian Electric Co, third.

Empolyee newspapers—A: Appalachian Electric Power Co, first; Georgia Power Co, second. B: Arkansas P&L Co, Ohio Power Co, Florida Power Corp. C: Potomac Edison Co, Central Hudson G&E Corp, Interstate Power Co.

A series of direct mail pieces—A: Consumers Power Co, Boston Edison Co, Cincinnati G&E Co. B: New Orleans Public Service, West Penn Power Co, Wisconsin P&L Co. C: Hartford Electric Light Co, Potomac Edison Co, Coast Counties G&E.

Single piece sent to customers—A: Public Service E&G Co, Georgia Power Co, Pacific G&E Co. B: Kansas Cty P&L Co, Ohio Power Co, Carolina P&L Co. C: Potomac Edison Co, second; Central Hudson G&E Corp, third.

Printed material for dealer promotion—A: Detroit Edison Co, first, Duquesne Light Co. and Cleveland El, tie for third place. B: Southwestern Public Service Co, New Orleans Public Service, Arizona Public Service. C: Central Hudson G&E Corp, second.

Special employee literature other than house organs—A: Florida P&L Co, Detroit Edison Co, Philadelphia Electric Co. B: Connecticut L&P Co, Arizona Public Service Co, Wisconsin Public Service Corp.

Window display—A: Northern Indiana Public Service Co, Ohio Edison Co, Consumers Power Co. B: Kansas City P&L Co, third. C: Minnesota P&L Co, Pennsylvania Power Co, Delaware P&L Co.

Interior display—A: Cincinnati G&E Co, Pacific G&E Co, Public Service E&G Co. B: Shawinigan Water & Power, Kansas Power & Light, United Illuminating Co. C: Washington Water Power Co, second, Pennsylvania Power Co, third.

Outdoor advertising—A: Public Service Co of Northern Illinois, second; Pacific G&E Co, third. B: West Penn Power Co, first; Wisconsin Public Service Corp, third. C: St. Joseph L&P Co, second; Washington Water Power Co, third.

Annual report to stockholders—A: Public Service E&G Co, Northern Indiana Public Service Co, Consumers Power Co. B: Dayton P&L Co, Shawinigan Water & Power Co, Arizona Public Service Co. C: Pennsylvania Power Co, second; Iowa Southern Utilities, third.

Radio advertising, one group—Pacific P&L Co, second.

Motion pictures, one group—A: Philadelphia Electric Co, Northern States Power Co, Pacific G&E Co.

Television, one group—Cincinnati G&E Co, second; Duquesne Light Co, third.

Single newspaper ad promoting use of electricity—A: Duquesne Light Co, Pacific G&E Co, Union Electric Co. of Missouri. B: Houston Lighting & Power Co, Narragansett Electric Co, Wisconsin Public Service Corp. C: West Texas Utilities Co, Hawaiian Electric Co, Pennsylvania Power Co.

Single newspaper ad selling electric merchandise—A: Consolidated Edison Co, Georgia Power Co, Public Service Co of Northern Illinois. B: Narragansett Electric Co, Wisconsin P&L Co, Texas Electric Service Co. C: Hawaiian Electric Co, Tampa Electric Co, Otter Tail Power Co.

Rochester G&E Puts Annual Report on TV

The customers of Rochester Gas & Electric Corp probably know more about the company than those of any other utility in the United States. If they don't, it isn't the fault of the company. In April the company presented over TV Station WHAM the show, "105." In advertising it the cast of characters was listed as "A Pair of Shoes," "A Pile of Coal," "Assorted Numbers," and "Money." The title of the show referred to the company's 105 years of operations.

Instead of being a mystery show as some TV viewers might have expected, the show was a documentary study of a bona fide typical customer who asked the question, "What do you do with the money I pay you every month?" From that point on the program was an attempt to answer this question and was based on the company's annual report for 1953. Most of the company's top management including Pre Alexander M. Beebee and three vice presidents participated.

The typical customer was chosen by the production department of the TV station. After screen and voice tests, Will Hamel, employed by Main Marine Corp, was chosen.

Each executive answered questions pertaining to his particular phase of the operation until Hamel found out what the company's responsibilities to its customers, community, and stockholders were; how the money was spent, and considerable other information about the utility. In this way the audience got the annual report.

WASHINGTON COMMENT

JESSE MOCK

Hearings continue before Congress this week on the new federal power bill for industrial development of atomic energy.

Electric utilities have a big stake in this legislation if present predictions on nuclear power growth are to be believed. Within the next three or four decades, nuclear power holds the promise of being as significant to electric utilities as hydroelectric power is today. As might be expected, there are threats of much more drastic government control over atomic power than there is now over hydroelectric power.

Nuclear Power Act: New words to be heard

The hearings this week and later closed-door discussion by the Joint Congressional Committee on Atomic Energy will determine more clearly the exact language of the new law. However, the bill drawn up by the committee (EW, April 26, p 6) gives a pretty good indication of the committee's position on nuclear power legislation.

Any comparison of the committee bill with the Federal Power Act will show a good many similarities. More important, it will show that proposed government control and regulation of nuclear power production will be much more far-reaching than any federal regulation the electric utilities have known up to this time.

The Federal Power Act was passed by Congress in 1920 setting up the Federal Power Commission to license hydro projects on navigable streams. The nuclear power bill would put regulation over the nuclear power industry in the hands of the Atomic Energy Commission.

A brief study of federal regulation over water power and proposed federal control over nuclear power brings out these sharp differences:

- An FPC license for a hydro project carries with it the right to use the water in a navigable stream. The government would keep title to any nuclear fuel for use in or produced by a nuclear power plant, even though the plant was fully licensed.
- Usual term of FPC licenses is 50 years. Proposed term of nuclear plant licenses is only 25 years, although the costs of a nuclear plant would be similar.
- An FPC license has no provisions for security clearance of engineers, operators, or managers. An AEC power license could involve all kinds of security measures.
- Under an FPC license, individual plant operators do not require individual federal permits. Under the nuclear power law, such permits would be required.
- Under FPC regulations, there are no restrictions on foreign ownership of licensed companies. Under the proposed nuclear power law, companies would not be licensed if more than 5% of the voting stock were held by aliens.

Included in the bill which deals with licensing of nuclear plants, provision is made for the disposal of by-product power from government-owned production plants. This is being interpreted by some lawyers as a preference clause.

The bill says this government-produced power may be used by AEC "or sold to other government agencies, or to publicly or privately owned utilities or users at reasonable and nondiscriminatory prices."

While the preference is not as clearly expressed as in the Flood Control and Reclamation Acts, it is possible to interpret the clause as giving publicly owned utilities some priority over electric companies in the purchase of such power.

Hearings Nearly Over . . . If the present Congressional timetable is adhered to, hearings on the nuclear power bill will be concluded late this week. The committee will then iron out the kinks and introduce it in final form around June 1. It will be scheduled for floor debate as soon as possible thereafter.

For the time being the bill is an impotent scrap of paper, but once it is enacted into law it could easily become the center of many a legal fight or regulatory scuffle just as the Federal Power Act has been during its 33-year history.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Silo built tier by tier finally brought the unsuspecting farmer into contact with the 2300-v line under which he had built it.

Multiple contingency outages of secondary network systems are, per vault, more than 98% double contingency outages (i.e. two or more units are out of service in a vault).

Boiler feed pump power becomes a larger part of total auxiliary requirements at higher pressures. Pump motor size may be limited by voltage drop during starting.

Mica paper is produced by partial thermal dehydration, quick immersion in sodium carbonate solution in which the local boiling expels the air from the interlamillar structure of the mica. Subsequent immersion in acid puffs the mica to 100 times the original film thickness. Washing and agitation result in a coherent sheet.

Most transmission lines have primary relay protection which will operate in 3 cycles or less.

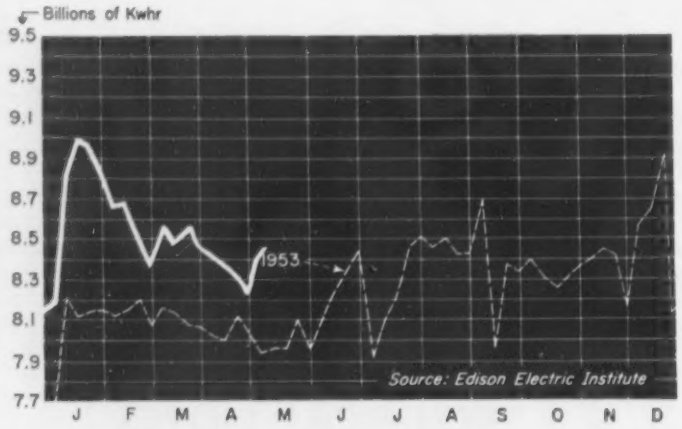
Eucalyptus growth is fast enough to produce 18,000 lb of wood an acre per year. On this basis 8 sq miles of forest would supply the fuel requirements of a 10,000-kw power plant indefinitely.

Tubular members could conceivably be used for substation structures to cash in on their strength-weight advantages, but the deterrent is the difficulty of joints and the maintenance of inside surfaces.

Soil resistivity to cable heat dissipation can be found by driving ¼-in. diameter hollow steel needles, 5 to 8 ft long, into the ground and for 30 minutes at half-minute intervals noting the temperature readings of thermocouples spaced at 1-ft intervals after the tube has been heated by internal resistors developing 15 to 25 w per ft.

Vulcanization of rubber connects its chain-like molecules into a loose 3-dimensional network but with only 1 or 2% as much cross-linking as is the case of the thermoset polymers.

STATISTICS



Output Week Ended May 8—8,438,000,000 Kwhr

Seasonally Adjusted Index†—169.2

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
May 8	+6.9	+5.2	+0.3	—0.8	+9.3	+19.2	+12.6	+8.2	+9.5	+7.5
May 1	+5.7	+0.2	+0.5	—4.0	+7.2	+19.6	+14.1	+7.6	+9.3	+6.4
Apr. 24	+3.0	—0.7	—2.1	—5.3	+6.7	+14.1	+8.9	+7.4	+6.9	+4.0

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Feb.	78.0	81.1	73.7
Capacity (Million Kw)	Feb.	92.46	91.68	82.83
Production (Billion Kwhr)	Mar.	38.92	35.21	36.97
Hydro	Mar.	9.92	8.56	10.20
Fuel	Mar.	29.00	26.65	26.77
Fuel Consumption				
Coal (Million Tons)	Mar.	9.89	9.07	9.44
Oil (Million Barrels)	Mar.	6.46	5.70	8.08
Gas (Billion Cu Ft)	Mar.	78.23	75.74	70.16
Sales (Billion Kwhr)	Feb.	32.37	33.45	31.21
Residential	Feb.	10.50	10.96	9.31
Commercial	Feb.	5.60	5.79	5.17
Industrial	Feb.	14.21	14.52	14.76
Other	Feb.	2.05	2.17	1.96
Net Income Class A & B Companies ($ Million)	Jan.	114.81	105.32	100.41
Estimated Dec. '54 Peak (Million Kw)	Feb.	92.5	93.4	96.0
Kwhr per Residential Customer (12 Month Average)	Feb.	2,382	2,363	2,198
Revenue per Kwhr Residential Service (12 Month Average)	Feb.	2.73¢	2.74¢	2.76¢
Canadian Production (Billion Kwhr)	Feb.	5.15	5.63	5.26

Business Statistics

FRB Industrial Production Index†	Mar.	125*	126	138
Gross National Production Annual Rate ($ Billion)	1stQtr	358.5	363.5	363.9
EW 4 Industry Production Index†	Mar.	113.1	115.0	127.0
ENR Construction Cost Index††	Apr.	129.0	128.7	123.6
BLS Consumer's Price Index	Feb.	115.0	115.2	113.4
NEMA Insulation Materials Sales Index†	Mar.	136	120	190
NEMA Electric Appliance Sales Index†	Mar.	105	98	140
NEMA Household Refrig. Sales Index†	Mar.	89	91	108
Metal Prices (May 11)				
Copper, Conn., V., lb		$.30	.30	.30
Lead, N. Y., lb		.14	.14	.13
Zinc, prime Western E. St. Louis, lb		.10¼	.10¼	.11
Tin, Straits, qual. N. Y. lb		.93½	.99½	1.05
Aluminum, ingot, base price		.21½	.21½	.20½
Nickel, base price		.60	.60	.60
Steel, billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1 heavy, Pitts., ton		28.00	27.00	44.00

*Preliminary †1947-49=100 ††1949=100

Households, Families & "Unrelated Individuals"

Between March 1950 and April 1953, the Bureau of the Census reports a three million increase in the number of households throughout the country. This rapid growth was largely a result of the rise in the number of households maintained by adults with no relatives sharing the home. That category, defined as "primary individuals", has increased by over one-fourth—27% in three years. In contrast, the percent increase in "husband-wife households" was only 4%.

Of course, in actual number of households, the husband-wife households still account for over three-fourths the total. However the numerical increase from 1950 to 1953 is only half taking place in that group.

That's in contrast to the 1940's when the proportion of married couples in the total population rose abruptly, and likewise, the proportion of these with their own households. About 85% of the household growth then took place among the husband-wife households.

The number of primary individual households has been on the increase over the past two decades as well as the particular rise noted recently. Reasons for this lay in the long-term increase in the proportion of older persons in the adult population, the concurrent decrease in proportion of young adults, and the rapidly growing proportion of older persons with their own households.

Nevertheless it would be misleading to say that we are becoming a nation of solitary-living individuals—93% of the total population still live in family groups. The remaining 7% represents persons living elsewhere apart from their relatives: "unrelated individuals"—6%, and persons living in institutions—1%. The proportion living in family groups was greater in rural-farm areas, 97%, while in contrast, urban areas have twice as many people living as unrelated individuals—8% as opposed to 4%.

The Census study further showed a drop in average number of persons per household from 3.67 in 1950 to 3.28 in 1953, reflecting a decline primarily in the number of adults per household.

Rule U-50 Change Opposed

Senators Douglas and Gore suggest the proposed change on competitive bidding for sale of utility securities be called off

Sen Paul Douglas (D-Ill.), former economics professor and now a stalwart among Democratic liberals in the Congress, has thrown his weight against moves by the Securities and Exchange Commission to change Rule U-50, which requires competitive bidding for the sale of utility securities (EW, Mar. 1, p 63).

On the Senate floor, Douglas recently lambasted the proposed rule change and suggested the whole thing ought to be called off. He suggested that if the rule is changed, then Congress ought to repeal the change by writing the old rule into the Public Utility Holding Co Act of 1935. Albert Gore, Tennessee's freshman Democratic Senator, quickly agreed with Douglas and said he would join with Douglas in proposing such legislation.

Rule U-50 Hits Senate . . . This is the first time members of the Senate have paid attention on the floor to the SEC proposal. In March, Rep Louis B. Heller (D-N. Y.) also criticized the proposal and said SEC might be called on for an "explanation."

Just how serious or widespread Congressional feeling is on this technical matter of utility financing isn't known. But it's clear Congressional Democrats will use any decision by SEC to relax U-50 as another bit of campaign material against what they call "the greedy scramble" for special favors by big business from the GOP Administration.

Douglas definitely played this line in his speech. He expressed amazement at the statement of SEC Chairman Ralph Demmler, answering a rhetorical question raised by pro-competitive bidding Robert R. Young, the rail magnate now making a fight to take control of the New York Central Railroad Co. Young implied that the idea to change U-50 came from outside the SEC, in banking circles.

Demmler quickly issued a press statement, saying the idea originated wholly within SEC and without prior knowledge of anyone outside the commission.

Douglas said he personally was amazed at this answer. He called the proposal one that would take the country "back 20 years into a new era of stock jobbery rigging." There must be some good reason behind a move to change a rule which has worked so well for 13 years, he said.

Harbinger of Acts . . . Douglas had an answer to his question. He called it a "harbinger of acts still to come." He called attention to $3 billion worth of tax writeoffs received by utilities and said rather than resulting in reduced rates to consumers, the accelerated depreciation will wind up "pure gravy for the utilities."

Douglas then ticked off a list showing how the other GOP administrators —particularly the Federal Power Commission—were chiseling away at public safeguards enacted into law over the last 20 years under the Democrats. He said the big bankers and big utilities are now getting on the "gravy train," too.

SEC is still mulling over the decision on whether to adopt the rule change or let U-50 stand as is.

PW&P Denied Appeal in $18-Million Damage Suit

The U. S. Supreme Court has turned thumbs down on an appeal by Pennsylvania Water & Power Co from lower court decisions, which had dismissed PW&P's $18 million treble damage suit under the antitrust laws against Consolidated Gas Electric Light & Power Co of Baltimore. In effect, the Supreme Court refusal to hear the appeal affirms the lower court decisions (EW, Dec. 28, 1953, p 65).

This action puts at rest a complicated dispute which began in 1949, when a Federal Power Commission rate order reduced PW&P's annual income from a power supply contract signed in 1931 with Consolidated by $1.7 million. PW&P then repudiated the 1931 contract, and got court invalidation of it on the basis that it violated the antitrust laws.

After failing in 1951 to get the Supreme Court to annul the FPC rate reduction order, PW&P filed the treble damage suit, claiming Consolidated had used the contract to prevent PW&P from building a steam electric plant. The courts dismissed the suit on grounds that PW&P was a party to the illegal contract, enjoyed its benefits at the time of alleged damage and could not recover.

Banking Group Acquires Southern Nevada Power

Reid Gardner, 56-year-old president of the California Interstate Telephone Co of San Bernardino and former president of Arizona Edison Co, recently succeeded Sam Lawson of Las Vegas, as president of the Southern Nevada Power Co (EW, May 3, p 69).

Lawson sold his financial interest in the power company to the William R. Staats & Co, the First California Co of Las Vegas and a group of individuals represented by the Los Angeles banking and investment firm.

Gardner will retain his position as president of the California Interstate Telephone Co, in addition to his local responsibility, but said after surveying the Las Vegas system: "At least 90% of my work in the next few months is cut out for me in Las Vegas."

In addition to Gardner's modernization plans at a cost of more than $1 million a year which does not include a $15 million outlay for steam generating equipment, Gardner said that local capital will be given an opportunity to invest in the power company.

"We want widespread local ownership," he said, in dispelling any thought that the company will be controlled by absentee directors.

The new president immediately set in motion a survey to discover what has been done and what still must be done in choosing a site for a steam generator, needed by 1956.

FINANCIAL BRIEFS

Stockholder Subscriptions: Northern States Power Co stockholders subscribed for 1,002,990 common shares of 1,219,856 shares offered on a 1-for-10 basis at $14 per share to yield 5.71%; balance 216,866 shares were taken by the underwriters headed by First Boston Corp.

Massachusetts has repealed the tax formerly levied on the transfer of stock within the state.

New Orleans Public Service, Inc, will offer to its commonholders 160,228 shares on a 1-for-7 basis at $25 a share. Middle South Utilities, parent and holder of 1,059,901 shares (95.255%) of the outstanding common stock, plans to purchase the number of shares to which it will be entitled.

San Diego Gas & Electric Co may issue some 800,000 common shares during the last quarter of 1954 . . . **California Electric Power Co** has deferred sale of 105,000 shares of $50 par preferred stock slated for May 19.

Southwestern PS Predicts $20-Million Offer in '55

A prediction that Southwestern Public Service Co will offer the public in February, 1955, an $18-$20 million issue of bonds and stock (preferred and common) to finance "extension to property" was voiced recently by H. L. Nichols, chairman of the board.

He said the company budgets about $24 million a year to extend its property, and rate of growth in the territory served by the company indicates similar amounts will be budgeted each year for the next three years.

Population growth in the Texas Panhandle has allowed the company to double its electric customers since 1943 and boost its gross electric operating revenues 250% since 1943, Nichols said.

The board chairman also hinted that Southwestern Public Service stock may soon be listed with the New York Stock Exchange. "Listing on the big board when the proper distribution of stock has been reached" would be in

(*Continued on page* 250)

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1954									
May 6	**2.86**	**2.92**	**3.14**	**4.02**	**4.14**	**4.52**	**4.77**	**5.20**	**5.46**
April 29	2.85	2.93	3.16	4.02	4.14	4.47	4.78	5.14	5.44
END OF QTR									
1st 1954	2.82	2.87	3.14	3.88	4.09	4.42	4.83	5.19	5.42
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10

Date: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Boston Edison	3	Mar.	$2,818,510	$2,650,703	$	$
Central & South West, consolidated	12	Mar.	15,803,072		1.74(a)	1.52(a)
City of Seattle, Wash.	12	Jan.	6,205,941	5,920,473		
Columbus & Southern Ohio Electric	12	Mar.	5,473,228	5,022,792	2.10(b)	2.18(b)
Commonwealth Edison and subsidiaries	12	Mar.	36,664,592	34,660,667	2.28(c)	2.29(c)
Consolidated Gas Electric Light & Power Co of Baltimore	12	Mar.	10,164,000	10,784,000	1.71(f)	1.94(f)
Duquesne Light and subsidiaries	12	Mar.	15,428,199	14,705,329	2.23(g)	2.20(g)
General Public Utilities, consolidated	12	Mar.	21,598,372	19,113,293	2.37(h)	2.10(h)
Interstate Power, subsidiaries	12	Mar.	2,486,191	2,400,852	.93(i)	.89(i)
Northern Indiana Public Service	12	Mar.	9,297,327	8,732,957	2.22(j)	2.37(j)
Rockland Light & Power and subsidiary	2	Feb.*	391,317	298,106	.21(k)	.15(k)
Tucson Gas, Electric Light & Power	12	Mar.	1,577,442	1,426,466	1.41(l)	1.32(l)
Utah Power & Light and subsidiaries	12	Mar.	4,890,626	4,812,640	2.39(m)	2.61(m)
			1953	**1952**	**1953**	**1952**
Arkansas Power & Light	12	Dec.	$6,293,598	$5,696,609	$	$
Citizens Utilities	12	Dec.	907,118	793,489	1.00(n)	.87(n)
Pacific Power & Light	12	Dec.	4,753,237	4,413,703	1.95(o)	1.80(o)

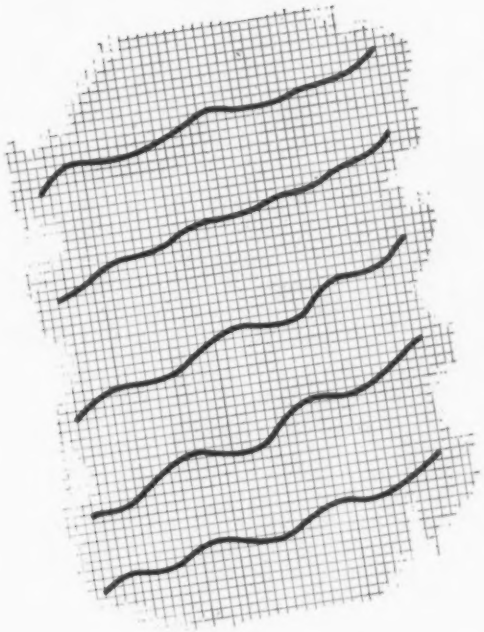
Notes—Figures shown for the last three companies have been audited; *Adjusted to reflect portion of 1953 adjustments of depreciation, acquisition and Appropriated Net Income applicable to two months ended Feb. 28, 1953; (a) Based on 9,091,257 shares issued and outstanding since April 27, 1953; (b) Based on 2,201,360 shares in 1954 and 2,001,360 shares in 1953; (c) Based on 15,234,829 shares in 1954 and 14,108,025 shares in 1953; (f) Based on 5,410,771 shares in 1954 and 4,945,266 shares in 1953; (g) Based on 6,150,000 shares in 1954 and 6,000,000 shares in 1953; (h) Based on 9,098,640 shares presently outstanding; (i) Based on total shares outstanding at end of period; (j) Based on 3,481,025 shares in 1954 and 3,117,794 shares in 1954; (k) Based on present shares outstanding; (l) Based on 1,000,000 shares in 1954 and 1953; (m) Based on 2 042 500 shares n 1954; (n) Based on 907,196 shares outstanding in 1953; (o) Based on 2,204 278 shares in 1953 and 2 200 000 shares in 1952.

FINANCING

Company and Description	Amount of Offering ($000)	Offering Price	Yield to Public
WEEK OF MAY 6-12			
Bonds			
Iowa Public Service—1st mtg 3% due 1984	$7,500	98.375%	3.08%
Debentures			
Montana Power—debs 3¼% due 1979	$18,000	101.721%	3.15%
SCHEDULE FOR MAY-JUNE			
Bonds			**Bid Date**
Virginia Electric & Power 1st mtg due 1984	$25,000	.....	May 17
Pacific Gas & Electric—1st mtg due 1984	65,000	.....	May 18
New York State Electric & Gas—1st mtg due 1984	20,000	.....	May 19
California Electric Power—1st mtg due 1984	8,000	.....	May 25
Public Service Electric & Gas—1st mtg due 1984	50,000	.....	May 26
Consumers Power—1st mtg due 1984	25,000	.....	June 2
Southwestern Gas & Electric—1st mtg due 1984	10,000	.....	June 8
Gulf States Utilities—1st mtg	24,000	.....	June 15
Jersey Central Power & Light—1st mtg due 1984	6,000	.....	June 15
Gulf Power—1st mtg due 1984	10,000	.....	June 22
Duquesne Light—1st mtg due 1984	15,000*	.....	June 29
Consolidated Edison Co of N Y.—1st mtg due 1984	50,000	.....	.....
Preferred Stock			
Missouri Public Service—50,000 sh $100 par	$5,000	.....	May 19(b)
Public Service Electric & Gas—249,942 sh $100 par	24,994	.....	May 19(f)
South Carolina Electric & Gas—80,000 sh $50 par cum	4,000	.....	May 20(b)
Florida Power Corp—75,000 $100 par cum	7,500	.....	May 26(a)
Gulf States Utilities—160,000 sh $100 par	16,000	.....	June 15
Duquesne Light	5,000*	.....	June 22
Public Service Co of New Hampshire—about 75,000 sh	7,500	.....	.....
California Electric Power—105,000 sh $50 par	5,250	.....	.....(c)
Common Stock			
General Public Utilities—606,423 sh (to be offered common holders on a 1-for-15 basis, May 12 to expire June 2)	.....	.....	.....
Philadelphia Electric—900,000 shs (to be offered common holders on 1-for-12 basis, record June 7)	.....	.....	.....

Notes—* Estimated; (a) Kidder, Peabody & Co and Merrill, Lynch, Pierce, Fenner & Beane group underwriters; (b) Kidder, Peabody & Co group, underwriters; (c) Deferred Merrill, Lynch, Pierce, Fenner & Beane group underwriters; and (f) Morgan Stanley & Co, Drexel & Co, and Glore, Forgan & Co group underwriters.

Trends in Distribution



For Rural and Residential Areas

Electrical World Reports . . .

- *Primary voltage moves toward 12 kv*
- *Bigger substations use higher voltage supply*
- *More primary circuits require cable*
- *Expansion policy features reliability*
- *Pole transformers and secondaries grow larger*

Dominant factor in distribution philosophy today is the marked trend toward higher primary voltages for rural and residential areas. As today's rural areas become suburban and commercial establishments move into residential communities, these new circuits will become general-purpose feeders.

Many utilities already accept this fact. They have adopted policies of holding older substations to their present load capability, relieving overloads by planned conversion to a new distribution voltage.

Today's practices and uninhibited predictions of impending changes reveal these important trends:

1. Primary voltage will rise to 12.47 kv, with alternates of 8.33 and 13.2 kv. But current programs for load relief reflect this long-range trend only occasionally.

2. Residential service will continue at 120/240 v.

3. Three-phase service will expand gradually using 3-phase transformers.

4. Greater reliability will be built into design standards.

5. Aluminum and ACSR will dominate distribution conductors. But copper remains the choice of nearly ¼th the utilities.

6. Shielded aerial cable is often favored to relieve tree and pole congestion difficulties.

7. Capacitors will enjoy increasing use, with emphasis on switching.

8. Trend to bus-regulated banks of 5,000 to 10,000 kva each, or larger, in distribution substations served by 69-kv or higher subtransmission seems to favor field assembly.

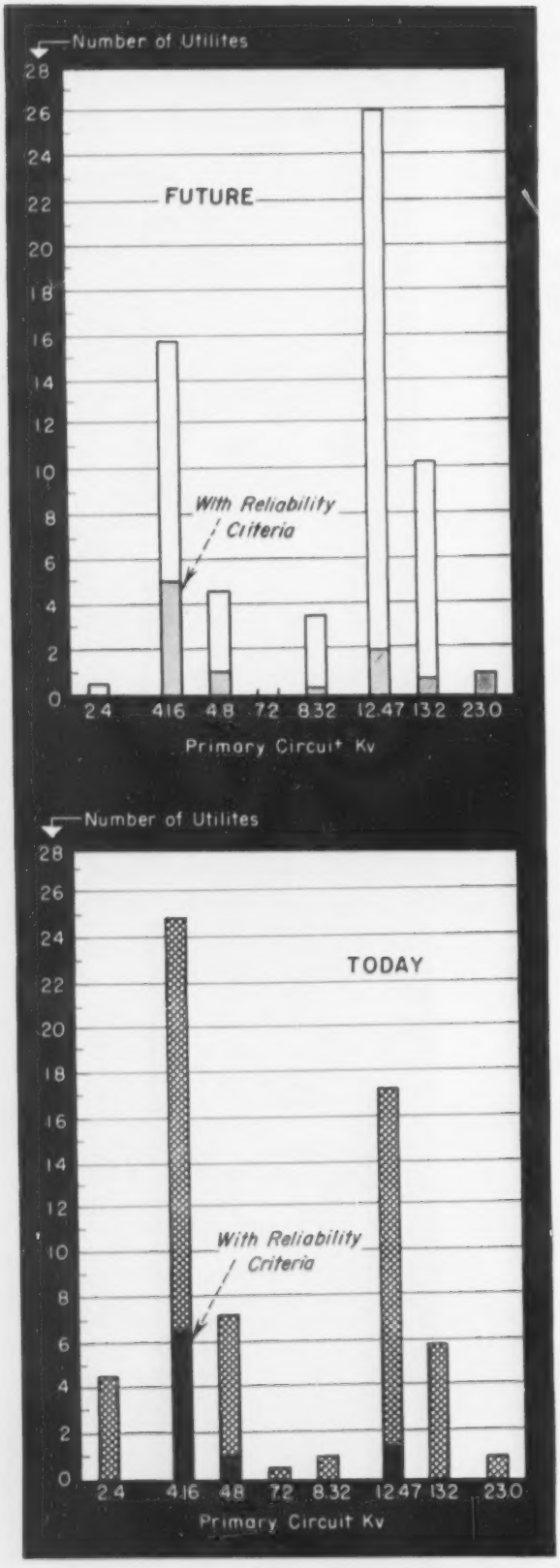
9. Larger number of circuits per substation may mean more cable exits.

10. Secondary conductors will be larger, and more utilities will use banked secondaries.

11. Self-protecting transformers face increasing use.

12. Most commonly purchased distribution transformer is approaching 25 kva from about 15 kva today.

Electrical World enjoyed in this survey the cooperation of engineering executives of 62 utilities serving 23 million meters. The experts freely contributed their knowledge and experience. Agreement in practices and predictions leaves no doubt that the consensus is a revelation of distribution trends.



Primary Voltage

• More Switched Capacitors

The key to trends for residential and rural overhead distribution is the upward spiral of primary voltage. Choice of 12.47 and 13.2 kv for the future is 42% and 17%, respectively, both nearly double the present percentages. Residual 2.4 and 7.2-kv areas will be converted to the corresponding Y voltages to take these older systems out of the picture. And remaining users of 4.16 and 4.8 kv decline from 52% to 33%. Three utilities indicate plans to convert to 8.33 Y.

No increase is shown for systems above 13.2 kv, but several utilities indicate consideration of 23 kv for the long range picture. At present only one reports use of this voltage.

Follow Long Range Plan . . . All of these conversions are following definite long-range planning philosophies. The general pattern is to surround the older system with new substations and feeders at the higher voltage. Then capacity relief for the older facilities is achieved by transferring fringes to the new system.

Interesting sidelight is the method reported by one large utility for eliminating its remaining 2.4-kv areas. Practice is to use 2.4/4.8-kv transformers for all additions and replacements. When capacity requirements dictate a voltage change, survey of facilities in the area determines whether to complete secondary neutrals into a common neutral for 4.16 kv or to reconnect and replace transformers for 4.8 kv.

Unit Systems Survive . . . Conspicuous exceptions to this trend are certain large utilities standardizing on unit substations at distribution load centers. Matching the substation to one or two heavy feeders simplifies design and retains benefits of high-voltage supply to the load center. These systems account in large measure for the degree to which 1,500 to 3,750-kva substations and 4.16-kv primary will remain in distribution's future.

Feeders from unit substations use heavy conductors, sometimes 4/0 copper or equivalent. And frequently lead-covered cable up to 500 MCM is used.

Aerial Cable Gains . . . Many utilities indicate use of aerial cable. Preference is generally for shielded, nonmetallic sheath types. Tree-trimming difficulties largely determine extent of use, but to some degree efforts to improve the appearance of overhead plant or or to reduce service hazards from a second circuit on a pole line are factors. Replies indicate future use by 63% of utilities, up from 60% today. And it appears that aerial cable may be used more extensively by utilities reporting present use.

Only 18% of utilities contemplate using aluminum conductors in their aerial cable.

Supplementary Regulation Accents Capacitors . . . Supplementary regulation out on the circuit gains greater ac-

Moves Toward 12.47 and 13.2 Kv

to Supplement Voltage Regulation

ceptance despite the inherent contribution of higher primary voltage. Trend to use primary capacitors is indicated for 60% of circuits, compared with 51% today. Even though voltage is not the objective in some cases, it always benefits from the capacitors.

This gain is almost entirely in switched capacitors. Time remains the preferred control method, up to 18% of all capacitors from 12% today. Second choice is voltage, up to 14% from 9% today. Current control, at 5%, is third choice, while a smaller number of switched capacitors will sense vars or combinations of several indices to control periods of operation.

Secondary capacitors likewise show an upward trend to 10% of all circuits from 6% today. But unlike primary capacitors, their popularity remains mostly in the Southern states.

Pole-Mounted Regulators Retain Place . . . Pole-mounted voltage regulators ease up to 16% from today's 15%. It might be inferred that some of these regulators will be used in combination with capacitors to attain the inherent advantages of both.

The fact that unswitched capacitors show no upward trend does not mean that no more unswitched installations will be made. It merely recognizes that a system can tolerate only a certain proportion of unswitched capacitors. As the system grows, so does the number of capacitors. But more reactive supply must be switched to avoid off-peak overvoltage.

Conductor Preference Shifts to Aluminum . . . Aluminum and ACSR show further gains for primary conductor use. Already used for 38% of construction, the trend is toward 51% in the future.

Significant in this gain is that of all-aluminum. Its use, although a small portion of the total, is expected to quadruple.

Contributing heavily to these trends are 18 utilities going virtually 100% to aluminum and ACSR for primaries. Three of these are converts from a 100%-copper policy today.

Copper continues to hold a substantial portion of the primary conductor field. Because of seacoast location or other reasons, 14 of the 62 utilities use copper almost exclusively today. And this number shows but little change in future thinking.

Trend Is to Bare Primaries . . . Preference for bare primary conductors is clear. Trend is to 82%, up from 77% today. These figures would probably run higher except that obsolete municipal ordinances in many localities specify covered conductors for several utilities.

Conspicuous among the adherents to covered conductor is one utility which contemplates extensive use of aerial cable laterals in its residential area.

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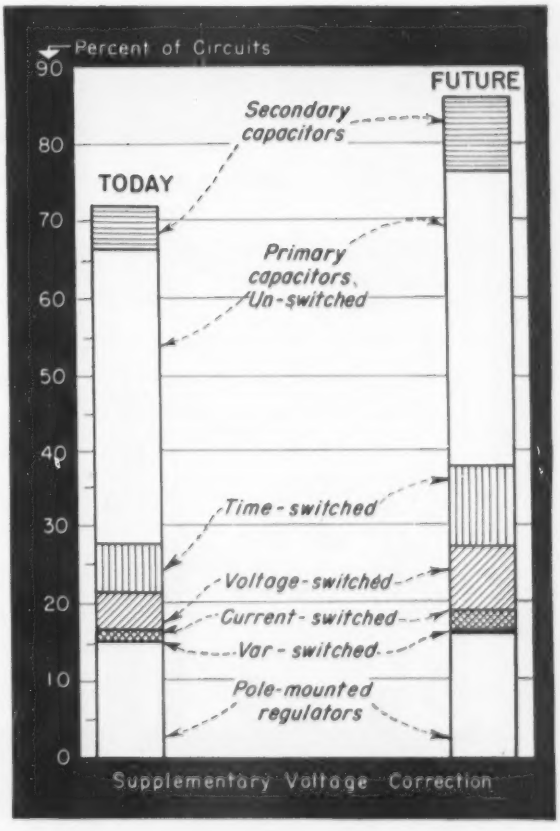
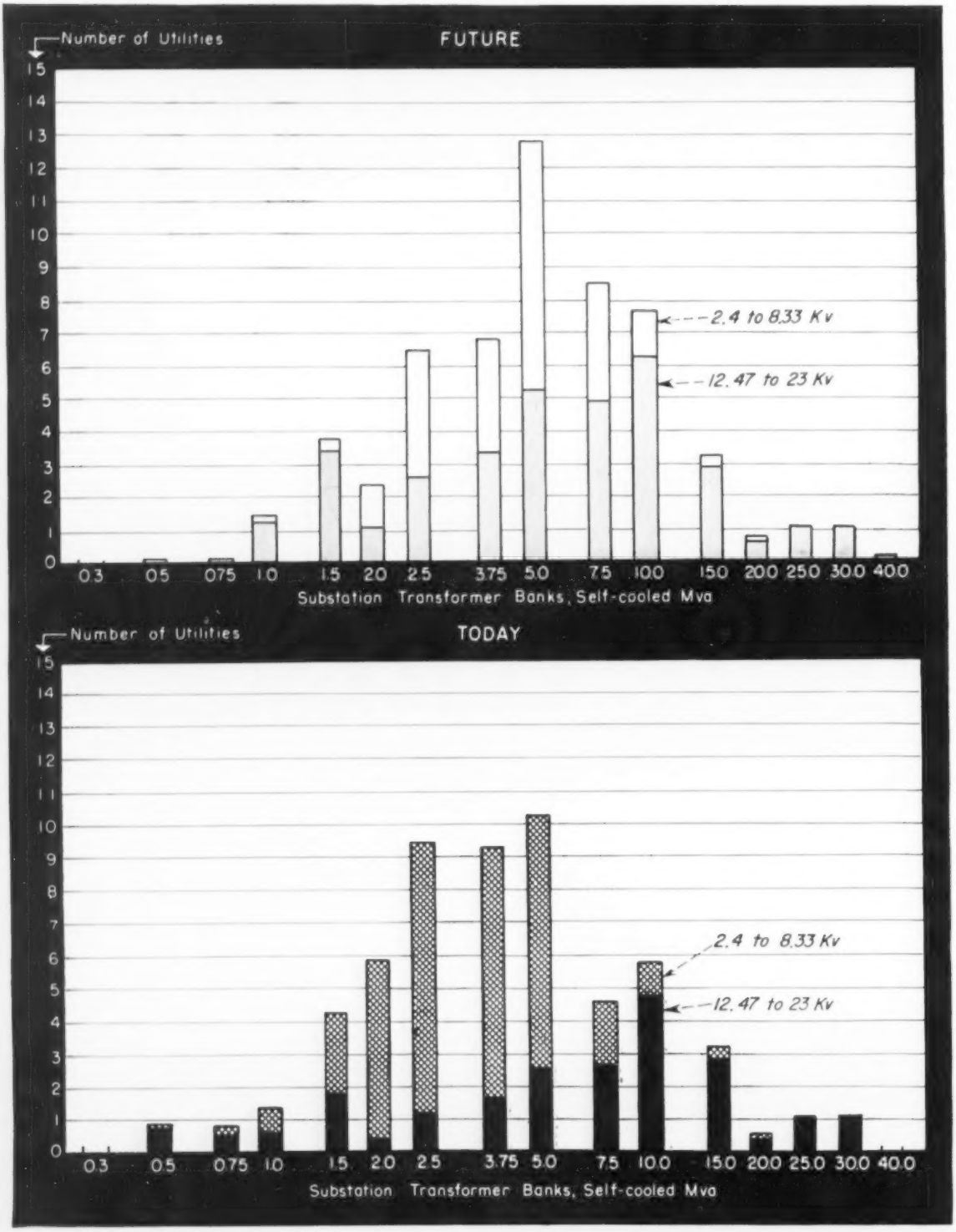


Distribution Substations Get Bigger,



Use Higher Supply Voltages

• Field Assembly Remains Preferred Type of Construction for Higher Voltages

Distribution substations grow larger again despite past doubts about large suburban stations. Most common bank today lies between 2,500 and 5,000-kva self-cooled rating. Output of each bank supplies 2 to 4 feeders, generally at 4.16 kv.

But the choice for 12.47-kv and higher feeder voltages already centers on 10,000-kva banks. And four utilities use banks of 25,000 kva and larger.

Today's trend to 5,000-kva banks accelerates, but the 7,500 and 10,000 kva move into second and third places. Clearly reflected in this change is the effect of boosting feeder voltage.

Marked drops in 2,000 and 2,500-kva banks may imply that the use of distribution units to combine merits of higher voltage feeders with convenience of 4.16 and 4.8-kv distribution is declining. Cutover to 12.47 kv and higher apparently supplants this distribution philosophy.

Choice of most companies reflects acceptance of NEMA standard ratings. But where non-standard sizes were reported, they have been interpreted here as proportioned between the two nearest standard ratings. Similarly a reported range of sizes has been spread over the standard ratings.

Field Assembly Is Preferred . . . Field fabrication remains the preference for distribution substations. Upward trend in primary voltage tends to accentuate this preference. For operators continuing in the below 10-kv bracket, unit substations will become increasingly preferred. But greater acceptance of units will depend upon their ability to compete for 12.47-kv system applications.

Indoor construction continues in about 7% of substations. Used only by necessity to place stations near their loads, it is confined almost entirely to 4.16 and 4.8-kv systems.

Loading Shows ASA Influence . . . Substation loading practice shows marked uniformity for most utilities. Reason may be their effort to apply ASA guides during recent critical material periods. Several actually designate "ASA" as their loading practice.

Future limits are not expected to deviate materially from present practice. Exception may come with greater reliance on forced cooling, despite the added voltage drop that goes with it.

69-kv Becomes Subtransmission . . . Voltage supplying distribution substations moves upward. Already 70% of the utilities use 34.5 to 138 kv, with 69 the most common. When 12.47 and 13.2 kv take over for primary circuits, future substations will be placed in less congested locations where 69-kv and higher voltage will become the preferred supply.

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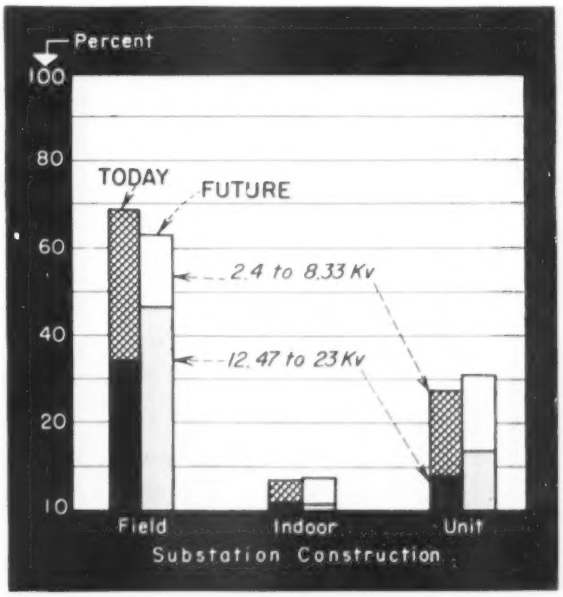


Substations Feed

• Congestion Forces Swing

More outgoing feeders mark the new substations. Most common practice today is two feeders. But future trend doubles the use of 6-to-10-feeder stations and almost eliminates the single-feeder unit. Stations of 1 to 4 feeders will drop from 76% today to 58% five or ten years hence.

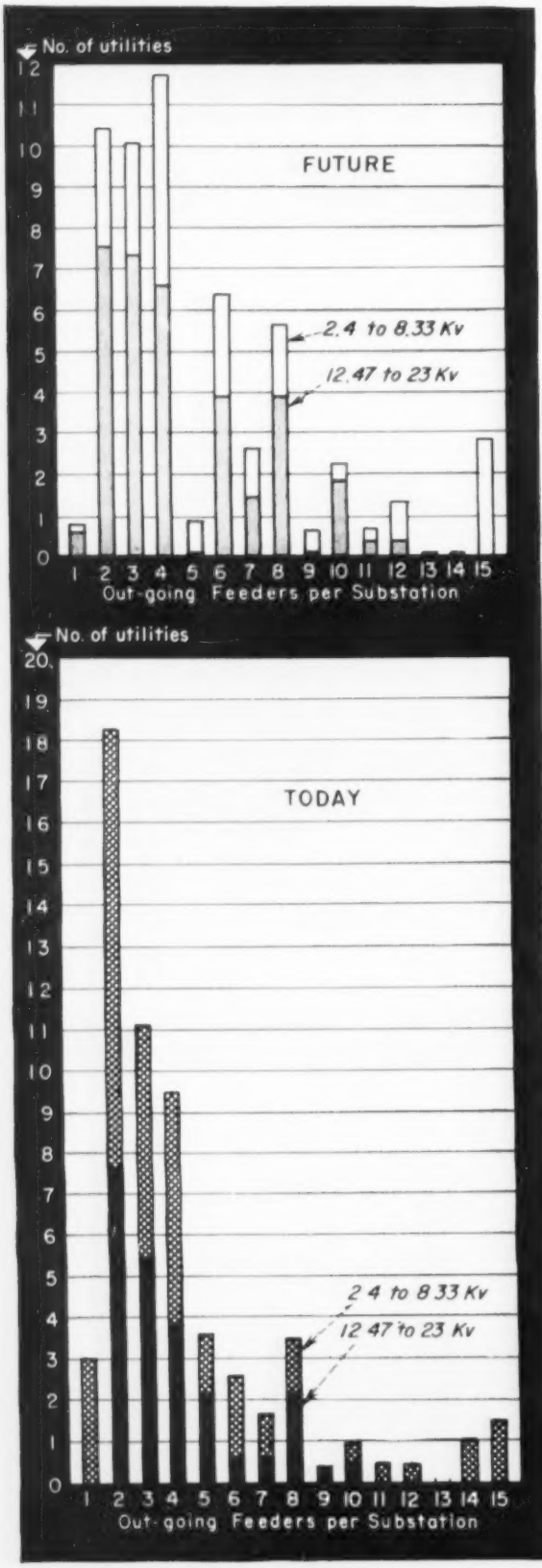
Reason for this shift may well be the apparent decline in 4-kv distribution. Systems using voltages in this range account for 65% of the 1 and 2-feeder stations today.

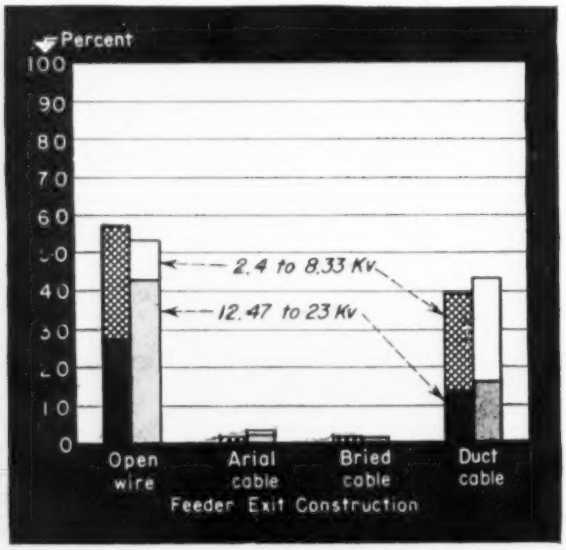
Cable Exits Increase . . . Inevitable problem of multi-feeder substations is the congestion of overhead circuits. Cable exits have been the usual solution. And the trend is toward greater use of cable, to a future total of 47% compared with 43% today, despite the obvious economic penalty.

Aerial cable remains a small factor for this application although current thinking indicates some increase. And direct-buried cable appears to be insignificant in the overall picture.

Open-wire connections show increased use for the higher primary voltages. This seems to reflect the greater latitude in choosing substation sites. Otherwise the future trend toward cable would be more marked.

Bus Regulation Gains . . . Voltage control at the substation bus gains acceptance, with trend almost 3 to 1 over individual feeder regulators. And 54% of replies prefer tap-changing transformers for this purpose. Neither feeder voltage nor number of feeders seems to affect these preferences.





More Circuits

to Cable for Feeder Exits

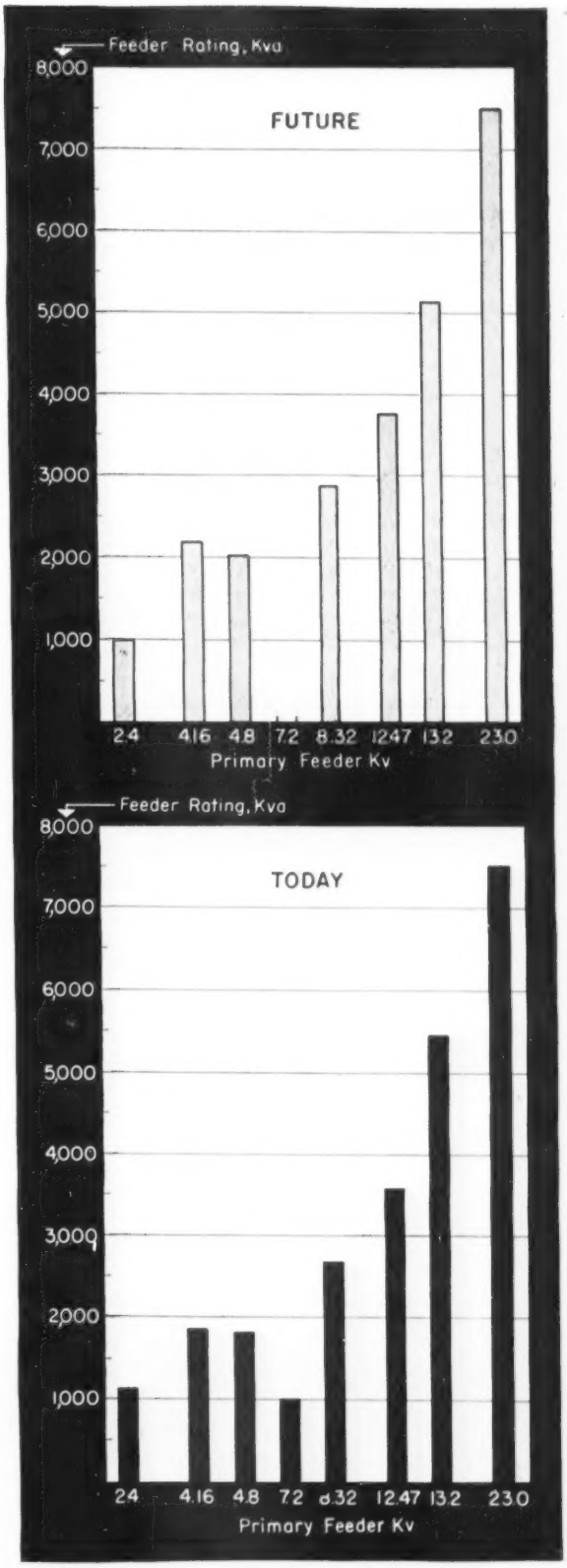
Voltage Change Boosts Capability . . . Raising primary voltage increases the capability of existing circuits in direct proportion to the voltage change. Thus a 1,500-kva circuit at 4.16 kv could become 4,500 kva at 12.47 kv. But replies indicate a tendency to use somewhat smaller conductors on the higher voltage circuits.

Utilities seem reluctant to use all of the gain in capability that higher voltage makes available. The overall gain in reported ratings attributable to voltage appears to be only about 18%. One reason is probably a desire to limit the load dropped by a circuit interruption. And it might be inferred that another segment of the industry thinks that feeder losses have been permitted to grow beyond economic reason.

Lower Voltage Circuits Up-Rated . . . Feeder capability is boosted by up-rating as well as by raising voltage. Gains on the order of 10% are contemplated for circuits of 4.16, 4.8, and 8.33 kv. But higher voltage circuits hold substantially their present ratings.

In many cases, too, the higher voltage circuits have been installed in light density areas. Voltage drop in the long circuits required to reach scattered load could restrict the load capability until area density grows materially. In the meantime the higher-voltage program must be expanded inward toward older low voltage areas to absorb their growth. Emphasis here would seem to be on more feeders, not bigger ones.

Both methods in combination are expected to boost the average circuit rating of all primary feeders to 3,330 kva from today's 2,740.



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Expansion Policy Regulates System

• Principles Applied in Additions Build Tomorrow's Distribution

Important to any review of distribution philosophy are the principles which govern the many individual projects. Distribution plant is the sum of many additions, large and small. And the full weight of a policy change is felt only after years of transition. The planning principles which guide utilities in their continual system expansion are revealing.

Rate of growth is important. Figures reported range from 4 to 5% per year in residential portions of several eastern metropolitan districts to 25% in portions of the Southeast. The lower rate of increase lends itself to prearranged new feeders and new substations following a definite schedule. The higher rate demands remedies which take effect quickly and require little planning and design.

Six Major Methods . . . Overall annual growth is reported at 11.2%. Capacity to carry this growth is provided mainly by these six methods:

1. Build new substations.
2. Add feeders to existing substations.
3. Add voltage corrective devices to stations and feeders.
4. Enlarge existing substations.
5. Convert to higher voltage.
6. Rebuild primary feeders with heavier conductors.

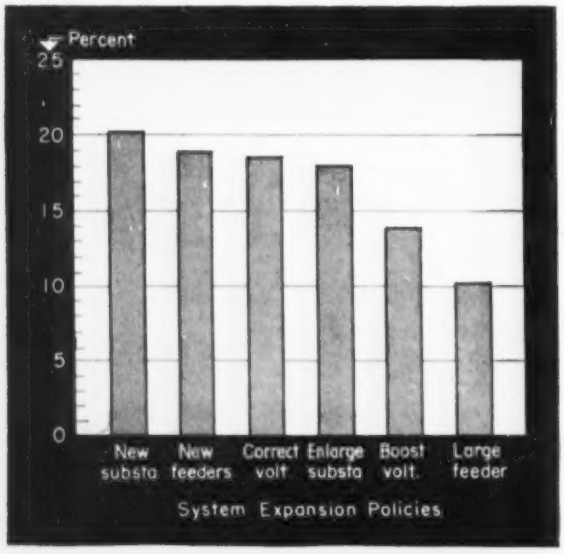
Only the third offers the advantages of speed and mobility. These devices can be engineered and installed in a few days, and relocated just as rapidly when need shifts elsewhere.

The other five methods all require advance planning and construction time. Once completed, they become a more or less permanent part of the system. And particularly for utilities which have settled the matter of future voltage, they constitute the fundamental solution to load requirements.

Planning Philosophy Determines Method . . . Choice between them is largely guided by basic planning philosophy. Utilities committed to the unit system in distribution seek more substation sites and extend subtransmission to the new load centers . Twenty percent of replies indicate the future objective of connecting these distribution units into primary networks. Variation of this system is to place another unit at an existing substation, adding its quota of feeders. More conventional is the practice of replacing substation banks with larger ones, adding feeders as required to reach the load.

Despite the long-range trend to higher primary voltages, current programs seem to apply this solution for only 14% of the cases. Included in this is the practice of several 4-kv systems which transfer distribution customers with demands of 400 kva and up to subtransmission. Included also are cases where conversion to higher primary voltages is in progress. But companies already virtually converted to higher voltage often cannot use this method. Nor can those whose policies preclude higher voltage for distribution circuits.

Least used is rebuilding primary feeders with larger conductors. Many replies condemn the high cost of this method, sanction its use only for unusual cases to alleviate bottlenecks where capacity otherwise is ample.



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Changeover

• Reliability Aims Influence Philosophies

Criteria for service reliability were reported by eight utilities and contemplated by another. That nearly 15% of this survey group is ready to build to such standards is a conspicuous advance in the industry.

Objective of eight of these criteria is to hold interruption time per customer below limits ranging from 30 to 120 minutes per year. One utility also limits the number of interruptions. Another has no time standard but seeks to hold primary interruptions to one per customer per year.

Eight of the nine utilities in this group use 4.16 or 4.8-kv feeders with loading limited to an average of 2,035 kva. One also has 12.47 kv but with a 2,400-kva limit. Effect is to limit both the mileage of circuit exposure and the number of customers affected by an interruption.

Except for two companies, this group plans to maintain substantially the same voltage and loading practice. But one company contemplates converting from 4.16 to 12.47 kv with 150% increase in circuit rating. The other also is boosting voltage but permitting more moderate increases in loading.

Utilities Survey Reliability . . . Numerous other replies indicate that outage records are considered in planning system protection. Several cite the objective of continued improvement in annual performance to the limit set by economic justification. And a few imply that standards may be formulated in the future.

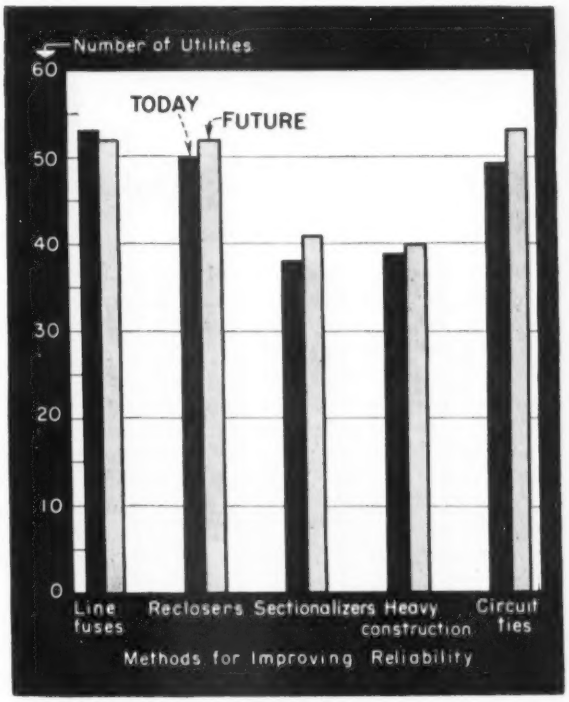
Methods reported by many utilities for improving line performance resemble so closely those used by the reliability criteria group as to imply that they could meet similar standards. Their provisions for isolating trouble and for restoring service also follow similar practices.

Heavier Construction Aids Service . . . Effort to improve reliability by building better distribution circuits is reported by 63% of utilities. In most cases increased conductor spacing is the principal improvement. But several companies serving severe storm areas also include storm guys for winds up to 140 mph.

Continued trend toward better construction is evident. But most convincing is the practice of utilities reporting criteria for severe reliability, 78% of which use heavier construction.

Line Protection Contributes . . . Important among the principles applied by most utilities are provisions for isolating faulted sections of primary circuits. Line fuses are the present choice of 85% of reporting utilities. Many also apply automatic reclosers (80%) and sectionalizers (61%).

Trend is upward for automatic devices in the future, to 85% for reclosers and 67% for sectionalizers. Doubtlessly this growth reflects successful performance of recent installations and the widening range of equipment ratings offered by manufacturers.



Circuit Ties Expedite Restoration . . . Most utilities reported in this survey also provide ties between circuits or between circuits and other substations for emergency supply. This practice trends toward 87% from today's 79%. Most companies depend on inherent emergency overload capability for this capacity. But one actually provides a transfer circuit which can pick up all circuits at prearranged points outside the substation.

All utilities using reliability criteria report the use of circuit ties. It is the back-up to their philosophy, which has these three points:

1. Build to minimize circuit trouble.
2. Use line protection to localize interruptions.
3. Provide circuit ties to pick up serviceable portions of plant expeditiously.

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Pole Transformers and Secondaries

• 120/240 Remains Preferred Service Voltage but 3-Phase Shows Steady Growth

Most commonly ordered distribution transformer today is probably 15 kva with trend indicated toward 25 kva in the future. Replies indicate that need for small sizes is largely met by returns from service.

Rural loads have spiralled upward to the point where many companies are buying 10 kva or larger. Trend for this area is clearly toward the 15. Only two utilities report 1½ kva in their range of ratings purchased. Nine start with the 3 kva, but nearly 60% show 5 kva as the smallest. Trend is clearly toward a minimum of 10 kva, with 42% showing.

Taps in distribution transformers will continue to be argued. Present practice is 72% for omitting taps, evenly divided between the 11 to 13-kv range and 8.3 kv and below. But proponents of taps are virtually all in the higher primary voltage group, and the upward trend in voltage reflects in a gain to 32% for taps. This situation implies need for review.

Loading by Temperature Continues . . . Loading distribution transformers to limits set by temperature will continue the general practice. Exception to this philosophy appears in the Southeast where limits as high as those in cooler climates are based on voltage drop more than temperature.

Self-protecting transformers grow in popularity, trending toward 54% acceptance. Enthusiastic endorsement is implied by one respondent's designation of loading practice as "CSP tripping."

Overload Indicators Needed . . . The future of conventional transformers may depend upon the development of acceptable load indicating devices. Replies indicate this combination is the choice of 4% of utilities today and 13% in the future.

Conventional transformers without such a device are slumping rapidly toward 33% acceptance. Saving feature may be well-grounded reluctance to use 1-phase self-protecting transformers for 3-phase loads.

Three-Phase Secondaries Expand . . . Growth of 3-phase secondaries is indicated by 53% of replies. Coverage exceeds 25% in several cases, but nationwide estimate is to 12% from today's 8%. Rural areas share this equally with residential.

Readiness to accept 3-phase transformers for power load in both residential and rural areas is clearly indicated. Replies show limited use today by 24% of utilities. Nearly 50% accept them as the future trend for banks between 9 and at least 150 kva. Most common rating may become the 75 kva.

More Banked Secondaries . . . Secondary banking gains favor for residential areas. Trend is upward from today's 35% to a probable 47% five or ten years hence. Four companies with No. 2 or larger secondaries propose to bank without conductor change, but two of three with No. 4 secondaries contemplate change to No. 2.

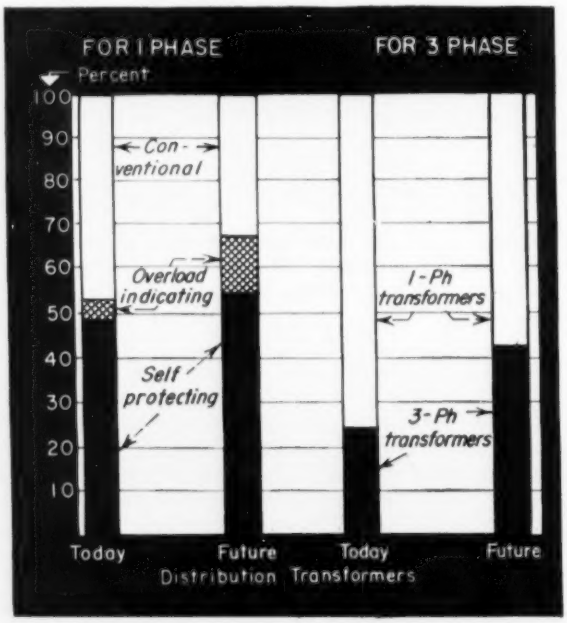
Expanding banks into overhead networks has few advocates although many of the companies operate networks in commercial centers.

Boost in secondary wire size is contemplated by 24% of the companies. Most common change is No. 4 to No. 2 and 1/0 copper or equivalent.

No. 2 is preference of 60% of utilities for residential areas. Range from No. 4 to 1/0 satisfies over 90%.

Trend to Aluminum Gains . . . Price differential accelerates swing to aluminum or ACSR secondary conductors. Totaling 35% today, trend is to 50% or higher. Number of utilities essentially standardized on the light metal approaches 28%, up from 23% today. This trend implies confidence that operating difficulties with today's aluminum conductors will not be severe and that future improvements will achieve complete satisfaction.

But despite its price disadvantage, copper remains the standard for 32% of the utilities today. Trend is downward but only moderately so. Proximity to salt water may explain adherence to copper in some cases, but apparent reason for most is reluctance to discard copper's inherent attractiveness to electrical people.



Become Larger

Service Voltage Remains 120/240 . . . Service voltage will remain 120/240 in residential and rural areas. Of utilities below that level the majority will build toward it in the near future.

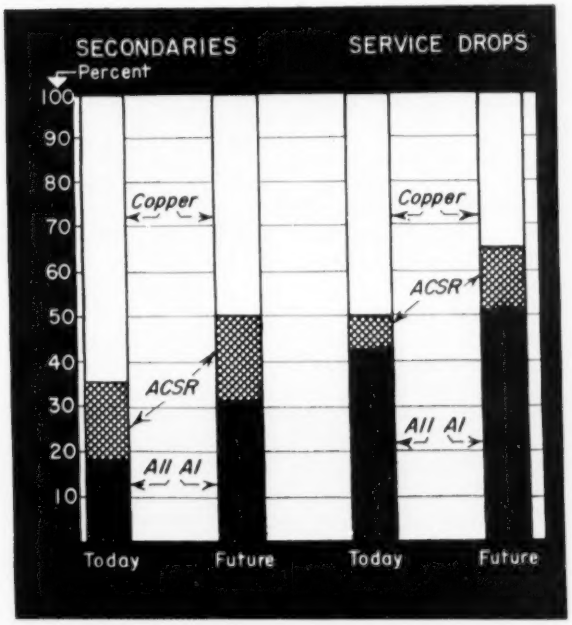
Service conductors will continue to feature No. 6 or equivalent conductivity. But the use of No. 8 declines from 27% to 16% while sizes larger than No. 6 climb to 26%.

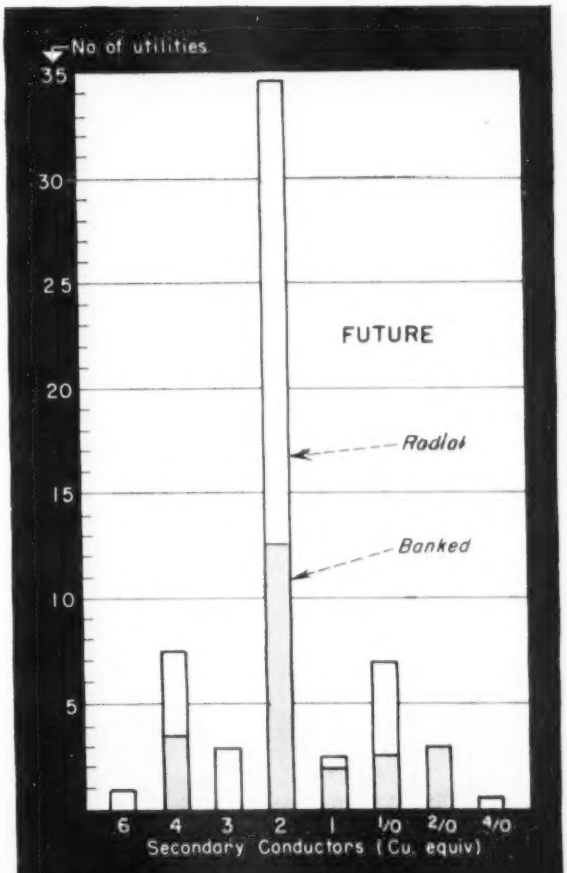
Cable advances from 38% to 58% for future service connections. Preference is for the pre-assembled or triplex type, with aluminum conductors supported by an ACSR neutral.

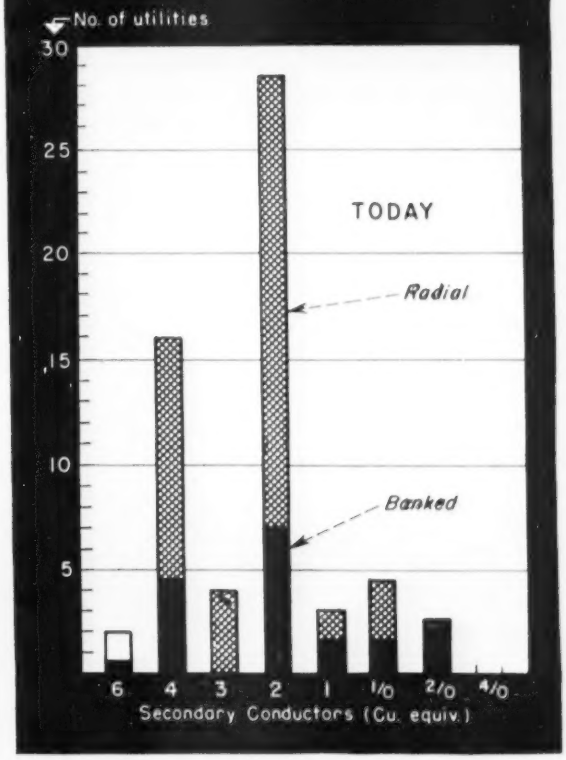
Copper Services Decline . . . Service drops display a greater acceptance of aluminum. Together with ACSR and either in open wire or pre-assembled cable, its trend is toward 65%, up from 50% today. Already 32% of the utilities have virtually standardized on the light metal. And the trend is toward 40%.

Here again some utilities adhere to copper, but the trend is downward from today's 24%. Proximity to salt water accounts for at most a third of these.

Strangely inconsistent is the small number of utilities proposing to adhere to copper for both secondaries and service drops. Trend is toward 13% even though 26% hold out for copper secondaries. Inference is that utilities have faith in the satisfactory solution of bi-metallic joints.







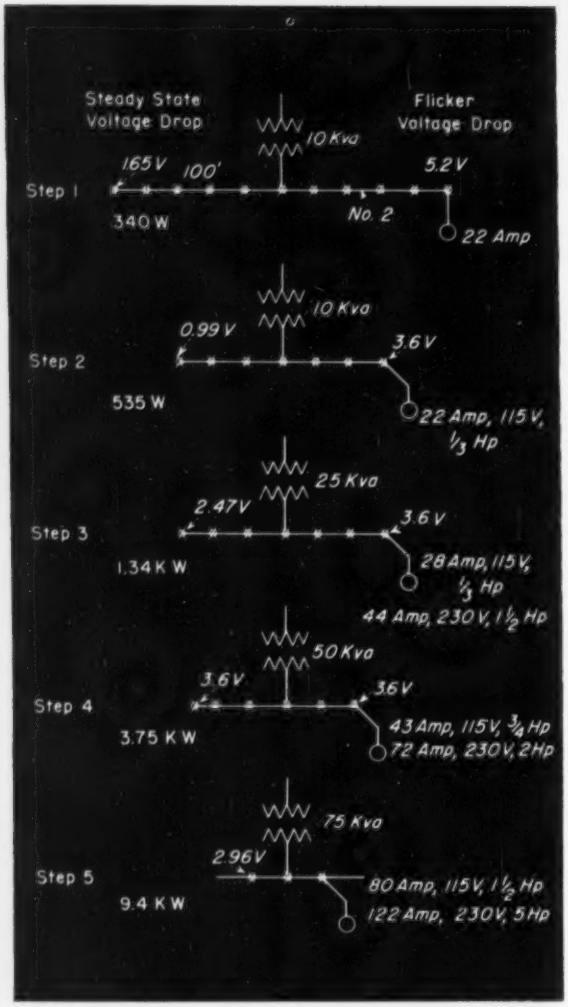


FIG 1—SECONDARY SYSTEM evolves as voltage drop requires shorter secondaries. Thermal limits successively need larger transformers

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Air conditioning and the heat pump present utilities with a motor load in residential areas that must be considered in designing systems today. According to industry estimates, by 1958 these devices for better living will be increasing yearly at the rate of 2,300,000 room air conditioners, 150,000 room air conditioners, and 35,000 heat pumps. Present-day distribution systems can be expanded to serve residential heating and cooling loads.

Many room air conditioners will be applied where distribution is well established and in new developments. The ¾-hp, 115-v unit, largest applicable to the normal 120-v residential circuit, will probably be the most popular.

Most of these units have a running current not over 15 amp and a starting current not greater than 46 amp at 115 v. Application of such units to a modern system

Adapted from a paper presented before the Pennsylvania Electric Association System Planning Committee, Pittsburgh, Pa., Feb. 8, 1954

Distribution Designers Can Solve . . .

Problems Posed by

designed for load growth should cause no apprehension about ability to serve. The only question is whether they are being served at the lowest practicable cost.

A ¾-hp room air conditioner has a demand of about 1,350 w at a power factor in the 70's. The cost of serving such motors can be kept to a minimum by correcting the power factor. Primary capacitors are often used for this purpose. But when secondary power factor is as low as that produced by room air conditioners, it is more economical to use secondary capacitors.

Room air conditioner manufacturers have had little incentive to improve the power factor in their units, especially as such improvement tends to increase the unit's price. But several ultilities have recently given them an incentive by advising manufacturers that only units with a power factor of 90% or better will be allowed on their systems. Undoubtedly the manufacturers will now investigate supplying kilovars in the unit itself.

Starting Currents of Integral Hp Sizes . . . Although manufacturers may be considering larger sizes for the future, most all-electric packages sold today for heating and cooling residences are of the 3 and 5-hp size. The starting current limit for connection to 240 v is 25 amp for automatically controlled devices started frequently. As 3 and 5-hp motor loads do not comply, most utilities must investigate individually their ability to serve them.

Single-phase 3 and 5-hp motors in heat pumps have respective starting current of approximately 70 and 100 amp. Starting values of 3-phase motors are 60 and 90 amp.

Calculations show that a 3-phase, 5-hp motor supplied open-wye open-delta has 0.2% less voltage drop during starting than a single-phase motor, when the motors are at the transformer. The 3-phase motor showed 0.6% less drop at the end of a 100-ft secondary. This small improvement indicates that the 3-phase motor has no real advantage over the single-phase motor, as far as voltage flicker is concerned.

Transformer Size . . . A 15-kva, single-phase transformer permits automatic starting of a 5-hp motor with about a 3.7% voltage dip when the service drop to the motor is connected at the transformer pole. When the service drop to the motor is taken off a No. 2 copper secondary 100 ft from the transformer, the transformer must be 25 kva to keep voltage drop to 3.7%.

When the motor is 200 ft from the transformer, the drop in the secondary becomes greater than that in the transformer. Consequently 5-hp motor service drops should not be located more than about 100 ft from the transformer to avoid voltage dips which might be considered excessive. As 3-phase motors show a very small improvement in voltage dip over single-phase motors, residences with 5-hp motors of either phase description shouldn't be more than one pole span from the transformer.

Home Motor Loads

Banking Secondaries . . . The feasibility of banking secondaries should not be overlooked in designing systems for the satisfactory starting of 5-hp motors. A few utilities have made a practice of banking secondaries for economy in places where the system capacity required for motor starting was greater than the steady state load.

With such banking a 5-hp motor can be connected to a No. 2 copper secondary midway between two 25-kva transformers 600 ft apart without causing more than a 3.3% voltage dip at starting.

Voltage Drop Limits . . . A modern radial residential secondary system has about No. 2 copper or equivalent secondary conductors designed so that the voltage drop during peak load does not exceed about 3 to 4%.

Load growth is handled by substitution of larger transformers at existing locations until voltage drop limits are reached. Then additional transformers placed at halfway locations can overcome voltage drop limits by shortening the secondary lengths. Provision for still further growth envisions the cycle of larger sizes being resumed until another voltage drop limit is reached.

As larger transformers are installed and secondaries shortened to stay within design limits, the system can be expanded to a 75-kva transformer on every third pole. This system, carrying a diversified demand of 9.4 kw per customer, is ample for full use plus air conditioning or even some space heating or heat pumps in some locations. When a demand of 9.4 kw per customer is attained, the thermal, voltage, and economic limits of No. 2 wire are reached.

A 75-kva transformer, overloaded 50% and feeding one span of 100 ft each way, is equivalent to about 28,000 kva per sq mile when secondaries are 300 ft apart. Hence modern secondaries can accommodate the coming home loads.

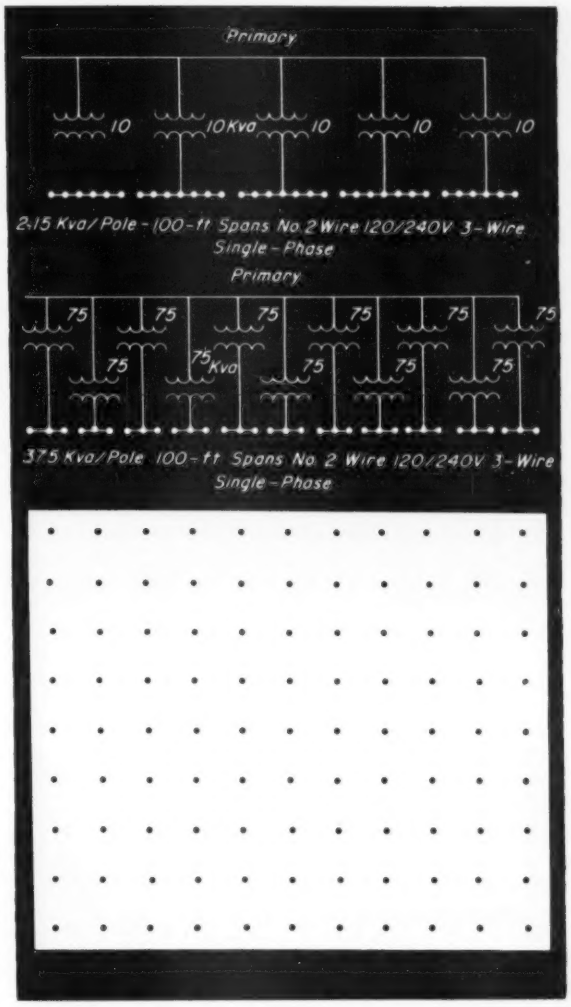

FIG 2—TRANSFORMER ROWS spaced 300 ft apart can serve about 28,000 kva per sq mile in areas composed of typical residential blocks

Type of Service . . . Three-phase service to a residence costs more than single-phase. Estimates of the cost of providing 3-phase, 4-wire service where single-phase, 3-wire service exists vary from $325 to $600, depending upon the load and the distance the additional primary phases must be run.

Some utilities supply 3-phase service to promote air conditioning load. The air conditioner buyer gets a package at a lower price for 3-phase service, and the 3-phase package air conditioner with a hermetically sealed motor

To the customer, the difference between a single-phase and a 3-phase heat pump is approximately $150 for a 3-hp unit and $210 for a 5-hp unit in favor of 3-phase. A package air conditioner with a hermetically sealed motor has a 3-phase price advantage of about $50 and $80 for the 3-hp and 5-hp units, respectively.

Manufacturers of heat pumps anticipate the use of hermetically sealed motors. These should decrease the difference in price between the single-phase and 3-phase heat pump units. But heat pumps probably will never have a price differential as low as air conditioners because of the difference in application of motors.

Installation Costs . . . Sometimes the wiring and fuse box make a 3-phase device more expensive to install. A user does not necessarily save all the difference in price of the package units.

The overall economics of serving cooling and heating packages is dependent upon the saturation of the devices. It requires comparison of extra utility cost for 3-phase with the net savings realized by the customers. If the future price difference between single-and 3-phase cooling and heating packages becomes less than $100, it is difficult to forsee a saturation of air conditioners and heat pumps high enough for 3-phase service to be economical.

Single-Phase Service . . . A utility gains certain advantages by supplying single-phase instead of 3-phase motors. The

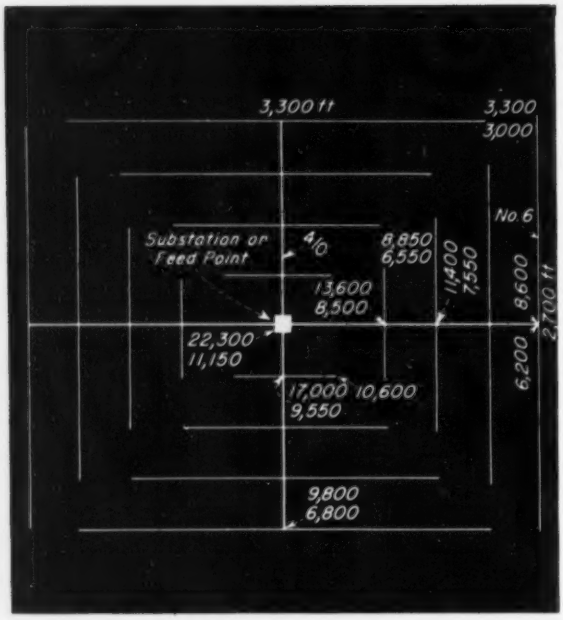

FIG 3—PRIMARY VOLTAGE of 4,160 can supply 2,700 by 3,000-ft area from one point with 3% voltage drop. Numbers denote short-circuit amps, upper for 10,000 and lower for 5,000-kva substation

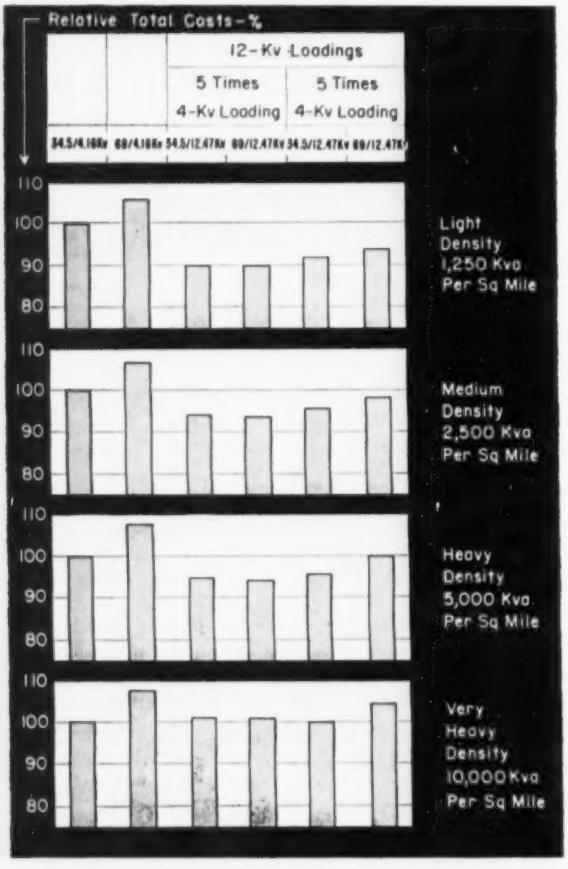

FIG 4—RELATIVE TOTAL COSTS of 4- and 12-kv primaries are related to area load density. Total costs converge as density increases

running power factor of the former is better because of its capacitor. This power factor is 90 to 95%, compared with 80 to 85% for a 3-phase motor. Consequently, a utility has less need to correct power factor for single-phase motors.

Utilities have no trouble with unbalanced voltages at the single-phase motors. But a slight unbalance in voltage builds up a considerable increase in phase amperes of a 3-phase motor. Probable consequence is overheating although burnouts are possible.

Motors are designed to operate at balanced voltage, and the degree to which the voltage can be unbalanced and still give satisfactory motor operation depends upon how much the motor is loaded. It has been the air conditioning manufacturers' practice to load motors close to their limits.

Primary System . . . When voltage drop is the criterion of design, 4 kv can supply an area 2,700 by 3,000 ft from one point with not more than 3% voltage drop between the first and last distribution transformers. This is illustrated in Fig 3. It can be done with 4/0 copper mains and No. 6 laterals. When circuits are arranged as shown, there would be about 300 amp per 4/0 circuit, a current within the wire's capabilities.

A 12-kv primary can serve from one point with a 3% voltage drop an area and load 5.2 times that of the 4-kv primary. Such a primary, however, requires a 46,700-kva instead of a 9,000-kva substation.

Current on a 12-kv system could be 1.74 times that on 4-kv. But in this case that would mean 525 amp per circuit, too much for 4/0 copper. System feeders must be increased because the thermal limit is reached. The 12-kv system hits its thermal limit before it can fully use its voltage capabilities.

Design for Current . . . When current is the design criterion, a 12-kv system can supply any area and load up to three times that of a 4-kv system. Higher voltage supplying high density loads requires fewer substations and feeders. A 4-kv system takes 3 to 5.2 times as many substations and feeders, depending on whether the circuits are thermally or voltage limited.

Short circuit currents shown in Fig 3 have two values, one based on a 10,000-kva and the other on a 5,000-kva transformer at the substation. The duties imposed on fuse cutouts range from 10 to 60% more for the 10,000-kva transformer over the 5,000-kva. Duties on cutouts become severe as densities go up, but even more severe for 12-kv when full advantage is taken of its capabilities.

The amount of tree clearance and the number of customers hit by an outage are other unfavorable aspects of the 12-kv systems.

Relative Costs . . . Relative costs of the 4-kv and 12-kv primaries vs density are shown in Fig 4. When density is light, the 12-kv system offers possible cost savings. These lie in the 12-kv system's larger substations and fewer lines and are greater than those to be derived from the smaller distribution transformer costs of the 4-kv system.

As density increases, the difference in cost between the two systems diminishes, and the 4-kv system may even become the less expensive. But the use of 12-kv for higher density areas might be justified, even at a higher cost, because of the congestion associated with the 4-kv system.

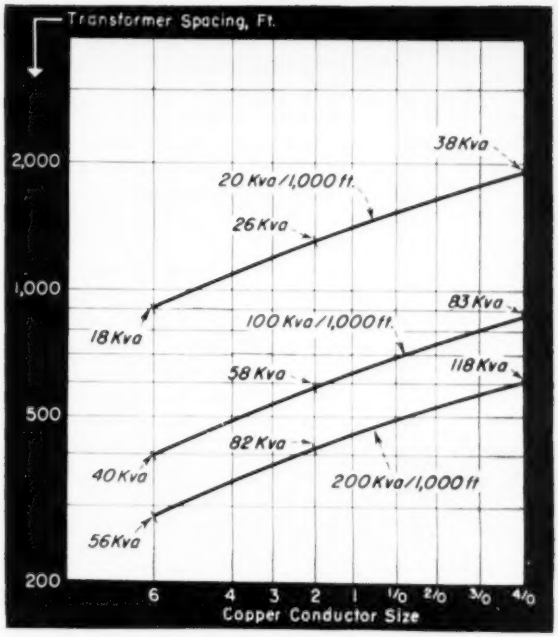

FIG 1—VOLTAGE DROP (3%) limits distance between transformers for 120/240-v secondaries at 8-in. spacing for balanced uniform loading from 20 to 200 kva per 1,000 ft at 0.85 pf. Transformers can reach the load of kva noted on the curves with acceptable voltage drop

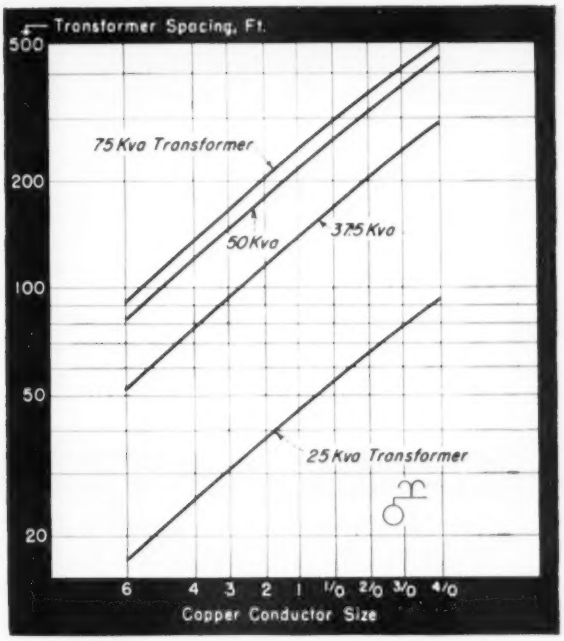

FIG 2—VOLTAGE DIP of 2.5% to start 5-hp, 220-v motor sets second distance limit for 120/240-v secondaries. Capacitor-start, capacitor-run motor, connected as shown, draws an in-rush current of 103 amp at 0.925 pf. Secondary conductors are placed 8 in. apart

120/240 V Can Serve Bigger Loads

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Prevalent 120/240-v, 3-wire, single-phase secondaries are capable of supplying economically growing residential loads comprised of bigger motor-driven devices.

Three-phase, 120/208-v, 4-wire service is and will be more expensive than single-phase, 120/240-v service for these loads throughout a reasonably predictable range of load densities, particularly if equivalent voltage dip and voltage drop limitations are met.

Practical factors may prevent realizing obvious savings in distribution transformers and secondaries that could result from use of 240/480 v instead of 120/240 v.

Brackets Residential Loads . . . A load density range of 20 to 200 kva per 1,000 ft of secondary main probably brackets the loads that will develop within the scope, timewise, of present planning. The density of 20 kva per 1,000 ft corresponds to about 1,000 kva per sq mi, which is a substantial part of existing residential areas. A density of 100 kva per 1,000 ft probably will be characteristic of many residential sections having a high incidence of heat pumps, room coolers, and similar loads. An upper limit of 200 kva per 1,000 ft appears to be high enough for present consideration.

120/240-V, Single-Phase . . . The maximum spacing between transformers of a single-phase, 3-wire, 120/240-v secondary system in 20 to 200-kva-per-1,000-ft load density areas, where a 3% voltage drop in the secondary mains is not exceeded —is shown in Fig 1. These calculations are based on balanced uniform loading at 85% pf along the main.

Thus, for a load density of 20 kva per 1,000 ft and No. 6 copper secondaries, transformer spacing can be 900 ft. For the same density and No. 4/0 secondaries, spacing can be nearly 1,900 ft. At this density a transformer can supply 18 to 38 kva—depending upon the conductor size—with no more than a 3% drop in the secondary mains. Maximum spacing ranges from 400 to 830 ft in a 100-kva-per-1,000-ft load density area. In this case the transformer can supply 40 to 83 kva within the 3% voltage drop limitation. Correspondingly more load can be reached at 200 kva per 1,000 ft.

When the load density is 20 kva per 1,000 ft, a No. 2 copper secondary —which is commonly used—will put 26 kva of load within reach of a transformer without exceeding a 3% drop. This agrees with the present average rating of distribution transformers (between 15 and 20 kva), the extensive use of No. 2 copper for secondaries, and a load density of about 1,000 kva per sq mi for present representative residential areas. A load density of 100 kva per 1,000 ft would permit using a 37½ or 50-kva transformer.

Can Serve Heavy Loads . . . The assumption of uniform, balanced load along the secondaries gives somewhat optimistic results. However the capabilities of the single-phase 120/240-v secondary system (Fig 1) show that the present method of distributing

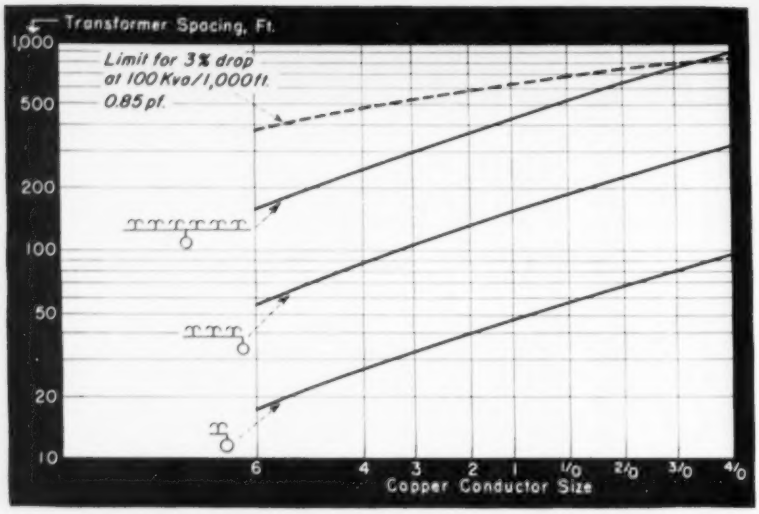


FIG 3—BANKING SECONDARIES extends transformer spacing for 2.5% voltage dip from starting 5-hp, 1-phase motor. Inset diagrams indicate banking arrangements with 25-kva transformers. Note that motor at center of six-transformer bank yields the optimum spacing

power in residential areas can be developed to carry heavy load densities expected to result from use of electric heat pumps and room coolers without excessive voltage drop.

Another factor is the problem of arranging secondaries and transformers so that tolerable voltage dip limits will not be exceeded during anticipated in-rush currents. To illustrate the problem, and possible solutions, a voltage dip limit of 2.5% is used as the basis for curves in Fig 2. A higher voltage-dip limitation would permit greater spacings between transformers unless some other limitation, such as voltage drop, were reached. For example, for a 5-hp motor supplied through No. 2 copper on a banked secondary arrangement, a 5% dip will allow two to four times as much transformer spacing as a 2.5% limit. While the latter limit is subject to considerable controversy, this value has been used in other analyses.

Fig 2 shows maximum transformer spacing in a single-phase 120/240-v secondary system if a total dip of more than 2.5% is to be avoided in the transformer and secondaries when a 5-hp motor is started across the line. These distances are based on an in-rush current of 103 amp at 0.925 pf, for a capacitor-start, capacitor-run, single-phase, 220-v motor. The assumed isolated radial arrangement of secondaries is illustrated by the small diagram. Spacing between is twice the distance between the transformer and motor where 2.5% dip occurs.

A 75-kva transformer and 4/0 copper secondaries would allow the motor to be only 250 ft from the transformer without causing more than 2.5% dip. Secondaries of No. 2 copper would permit locating the motor only 100 ft from a 75-kva transformer.

Transformer spacing of 200 ft permits 20 kva of load per transformer when the density is 100 kva per 1,000 ft. Therefore, a voltage dip limitation of 2.5% in the 5-hp motor, No. 2 copper secondaries, 75-kva transformer case, makes it impossible to load the transformers effectively. Use of 4/0 copper secondaries with 75-kva transformers would allow only about 50 kva of load per transformer in a 100-kva-per-1,000 ft area under these conditions.

In light load density areas and in most residential areas in earlier periods the in-rush currents to refrigerators and similar motor-drive appliances supplied at 120 v caused a voltage dip problem that could be solved in the isolated radial secondary arrangement only by using heavy secondary mains or by installing more transformers closer together. This required more capacity than necessary to carry the load only. Many engineers believe it is less expensive to buy volts in more transformer kva than in bigger secondary copper.

Banked Secondaries Reduce Flicker . . . Secondary banking has been recognized for a long time as an effective way to reduce voltage dip. It is especially applicable in areas where the voltage dip problem calls for excessive transformer or secondary capacity.

Some benefits of secondary banking are indicated in Fig 3. Banking three transformers together along a secondary main, at the end of which the motor is connected, allows the transformers to be about three times as far apart as in an isolated radial secondary system without exceeding the voltage dip limitation. For example, on a No. 2 copper secondary the transformers can be only about 40 ft apart if the secondaries are not interconnected. However, when the secondaries of three transformers are interconnected and feed a motor at the end of the secondary stub, the spacing between transformers can be about 125 ft. If the motor is in the middle of a banked secondary arrangement comprising six 25-kva transformers, they can be about 370 ft apart or about ten times the spacing allowed when isolated radial secondaries are used.

Loads Transformers More Effectively . . . Banking the secondaries permits loading the transformers more effectively. If the secondary mains are No. 2 copper, the isolated radial secondary arrangements can reach only about 4 kva of load for the 25-kva transformer in an area where the load density is 100 kva per 1,000 ft. The line bank with the motor at the end can reach nearly 15 kva for each 25-kva transformer. And when the motor is in the middle of a 6-transformer line bank there is about 38 kva of load within reach of each transformer.

The voltage drop curve at the top of Fig 3 shows the maximum reach of secondaries in a load density of 100 kva per 1,000 ft without exceeding 3% drop. There is a reasonable balance of the factors in the problem when the secondaries are banked and the voltage-dip-producing motor is in the middle of the bank (or anywhere on a loop arrangement of banked secondaries). The transformers can be effectively loaded in an area where the density is 100 kva per 1,000 ft without exceeding a 3% drop in the secondaries or a 2.5% dip when a 5-hp motor starts.

Single-phase, 120/240-v secondaries now prevalent in residential areas can serve the bigger loads and higher load densities that are generally anti-

cipated. To do the job will, of course, require adding more transformer capacity, banking the secondaries, and perhaps replacing some of the smaller conductors with sizes that are commonly accepted as more practical such as No. 2 copper.

120/208-V, 3-Phase . . . Relative capabilities of single-phase and 3-phase systems are indicated in Fig 4. The 3-phase, 120/208-v system for any given size of conductor can reach farther than the single-phase system without exceeding a voltage drop limitation such as 3%. (See curves in upper part of Fig 4.) For example a No. 2 copper conductor permits the transformers to be spaced about 575 ft in a single-phase system and about 700 ft in a 3-phase system.

Permissible spacings for a 2.5% voltage-dip limitation are shown for two transformer rating levels in banked-secondary arrangements for a 5-hp motor. The allowable spacing is smaller in the single-phase arrangement because the higher power-factor, single-phase, motor-starting current produces relatively more dip in distribution transformers and secondaries where the resistance-to-reactance ratio is high. When larger secondary conductors are used, this effect is reduced. In fact, when 15-kva transformers and heavier copper are used the reach is greater in the single-phase arrangement. From the standpoint of meeting voltage-dip limitations, the single-phase and 3-phase systems are practically comparable.

115-V Motor Flickers 3-Phase . . . The ¾-hp, 115-v motor causes relatively more voltage dip in a 3-phase system than in a comparable single-phase system because of the difference in impedances imposed by the transformers.

Either single-phase or 3-phase arrangements provide a reasonable balance of the factors in a 100-kva-per-1,000-ft areas where 50-kva or 45-kva transformers feed into secondary conductor sizes of about No. 2 copper or equivalent (Fig 4). The transformers can be effectively loaded without exceeding a 3% drop or a 2.5% dip when a 5-hp motor starts.

As single-phase and 3-phase arrangements are reasonably comparable in capability to serve anticipated bigger loads and higher load densities, it becomes essentially a question of which system costs less. Within the range of transformer sizes and load densities corresponding to anticipated heavier loads, the 3-phase arrangement of transformers and secondaries appears to cost about 50% more. This does not include the higher cost of 3-phase services, metering, and primary feeders.

Users May Demand 3-Phase . . . In spite of the economic disadvantage of the 3-phase system, it may become necessary to use 3-phase service because of user demand for the less expensive 3-phase, 3-hp and 5-hp motors. Motor cost is less for 3-phase than single-phase, but costs of wiring and control may be more for 3-phase equipment. It is likely that a little change in some of the factors could make the overall cost favorable to either the 3-phase or the single-phase method.

240/480-V, Single-Phase . . . The possibility of using 240/480-v secondaries has been suggested many times. Undoubtedly such a higher voltage would reduce the cost of the transformer-secondary main part of the distribution system. However, the overall economy and feasibility should be carefully considered before the higher voltage is generally adopted. The most important factor preventing the general realization of the theoretical economy of the higher voltage is the necessity to serve 120-v loads that will, for a long time, make up a substantial part of the residential load.

Of course autotransformers provide several technically practical ways to provide the supply to the 120-loads from the 480-v circuits. In one such arrangement, an autotransformer might be a part of each service to supply the lower-voltage loads in each provide the supply to the 120-v load, and the diversity among the loads, might require as many or more kva of small autotransformers as would be required in distribution transformers. This is especially likely if reasonable voltage dip and voltage drop limitations are to be met. These autotransformers will offset some of the savings resulting from using 480 v.

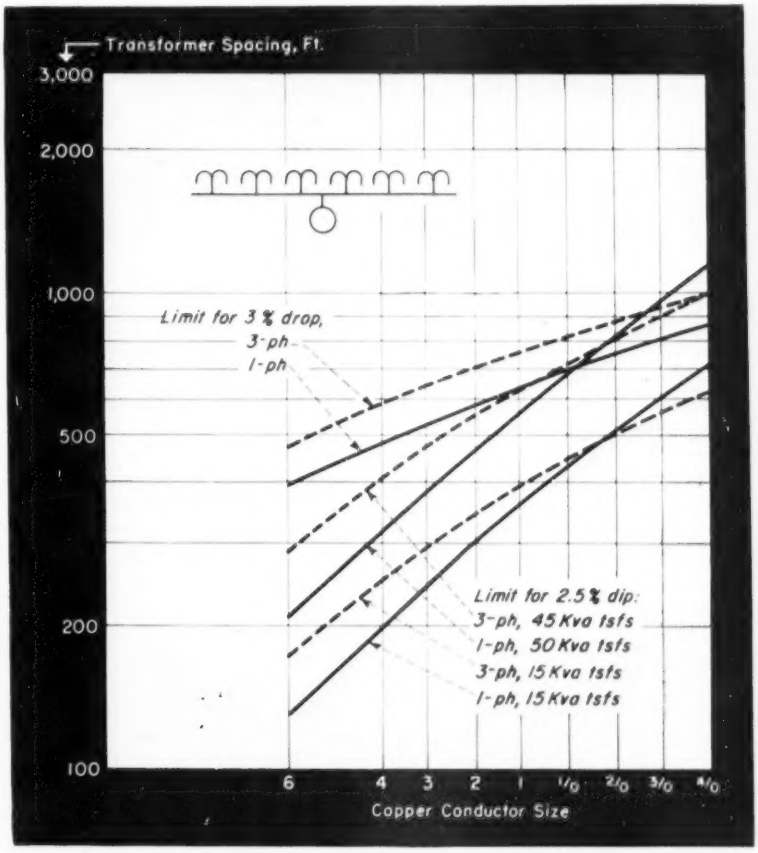
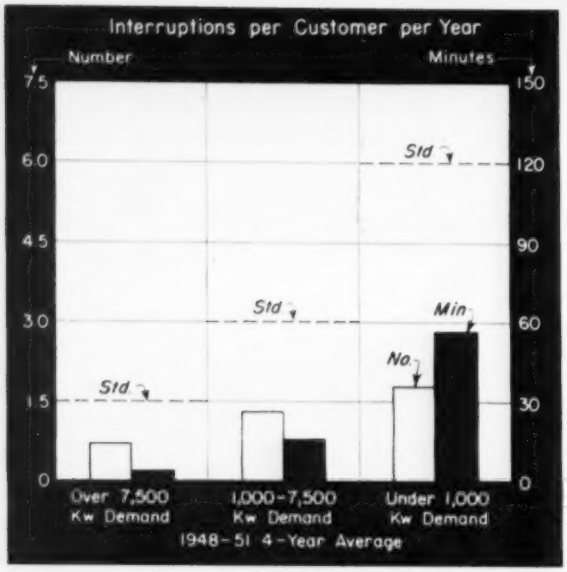


FIG 4—THREE-PHASE, 120/208-v system gives little improvement over 120/240 v for start-in 5-hp motor. Motor draws 103 amp, 1 phase, 0.925 pf; or 84 amp, 3 phase, 0.575 pf



← Industrial and Commercial

Customer kw demand	Over 7,500
Interruptions per customer per year	1.5
Minutes per customer per year	30

Distribution

Interruptions* per customer	
Minutes per customer per	

*Over 2 minutes duration

Service Reliability Standards

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Service continuity standards provide valuable guidance to operators and designers of modern distribution systems. Outstanding advantage is elimination of confusion and controversy about how distribution substations and industrial customers should be served. Economy frequently results because decisions based on judgment and experience tend to adopt the proposal which offers better service.

Performance standards isolate for special investigation the few cases where extra facilities will be needed. They also eliminate the tendency to overbuild the many connections where simplicity is acceptable. Thus they assist the planning engineer to combat rising distribution costs.

Standards Set Interruption Limits . . . Duquesne Light's standards define the acceptable upper limit for number and duration of service interruptions. Average performance is much better, running about half these interruption frequencies and durations. Probability of exceeding them is about 1 to 6. But these standards are reviewed occasionally to evaluate changing conditions and the growing importance of continuous service to new electrical devices.

Service quality is affected by differences in supply method, exposure, protective devices, and pure chance. Probability theory is an important tool. Variations from exceptional years are reduced by using four-year averages to measure performance. A longer period could minimize these variations, but the effect of upward or downward trends would be screened out.

Subtransmission Connections . . . Large commercial and industrial customers and distribution units are served individually from the 12, 23, and 69-kv systems. The larger loads usually justify duplicate service and automatic switching which make for very good continuity although one 40-Mva customer has had excellent service for years from a 14-mi radial line. The revenue from small customers seldom supports much extra investment.

Continuity standards divide high-tension customers by kw demand and set interruption limits accordingly. Public safety considerations, as for a hospital, can justify better service facilities than are stipulated by the standard. But experience has produced few cases where deviations are required.

Customer interruptions come mostly from the 23-kv subtransmission system. Very few originate in power stations or 69-kv transmission. Past performance of the particular lines involved is always investigated. But empirical methods applied to performance records have produced this formula for interruptions per customer per year:

$$N = 0.52 + 0.5\ M$$

where M = miles of line between automatic circuit breakers
and 0.52 includes all factors such as substation failures, operating errors and other causes.

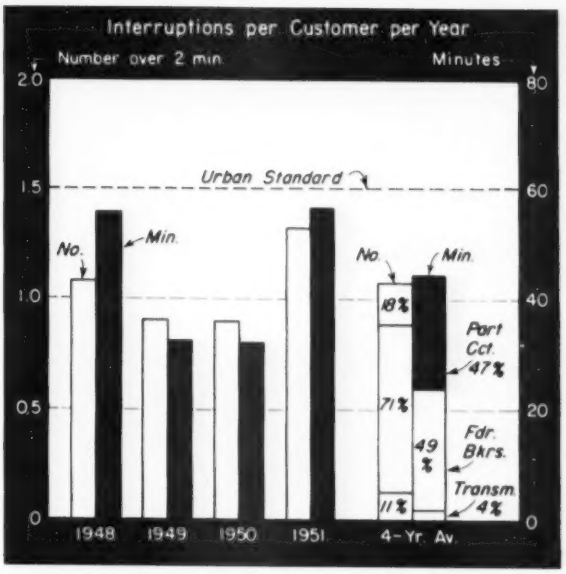
Applying this formula to proposed system additions often shows that a single-tap connection will meet continuity standards. Such cases are common where the subtransmission is a short loop between two company or customer substations with automatic circuit breakers. The excellent overall performance of the supply system has permitted many distribution units to be connected in this manner. Without the guidance of

Standards

1,000–7,500	Under 1,000
3.0	6.0
60	120

Customer Standards

	Urban	Rural
per year	1.5	3.0
year	60	120



Aid Planning and Operation

continuity standards all would probably have had duplicate connections, with automatic switching in many cases.

Rectification of sub-normal service here involves improved relaying, automatic service-restoring, and sometimes duplicate lines. Automatic airbreak switches or reclosing circuit breakers have been used. Supervisory indication to dispatching headquarters expedites the work of troublemen and emergency crews. This method of determining the supply facilities for large customers has been the most rewarding application of continuity standards.

Distribution Connections . . . Continuity of service on the distribution system involves the additional exposure of primaries, secondaries, and transformers. Urban areas have high customer density with circuits of relatively heavy conductor and low wire mileage. Shielding against lightning is inherent because of proximity to buildings and shade trees. And revenue justifies more reliable equipment and better protection for these service areas.

Rural customers often are inconvenienced more seriously by service interruptions. But economic considerations usually dictate longer spans, smaller conductors, and less substantial construction. Tree trimming and other functions also tend to be more limited.

The large number of distribution customers precludes application of service continuity standards for each individual customer or each distribution transformer. Instead standards are established on the basis of substation areas. Interruptions of two minutes or less, representing reclosing time after a temporary distribution fault, are not counted.

An important corollary to these distribution standards is that operating facilities must be adequate to restore service to all interrupted customers within four hours. Exception is allowed for very infrequent storms and other conditions of extreme severity. Methods used include manual operation of pole top switches to transfer dead circuits or major parts of them to adjacent circuits, repair of damaged conductors, replacement of defective distribution transformers, etc. Sufficient crew personnel, adequate communication facilities, and store room supplies must always be provided. Without these provisions a small number of distribution customers could experience very long outages without serious reflection in the overall continuity record.

Design Aids Reliability . . . Circuit design can contribute to service continuity. Investigation indicates a degree of correlation between primary circuit mileage and number of interruptions. And it has been found that lengths over 10 miles often fail to meet continuity standards if protection is only at the substation.

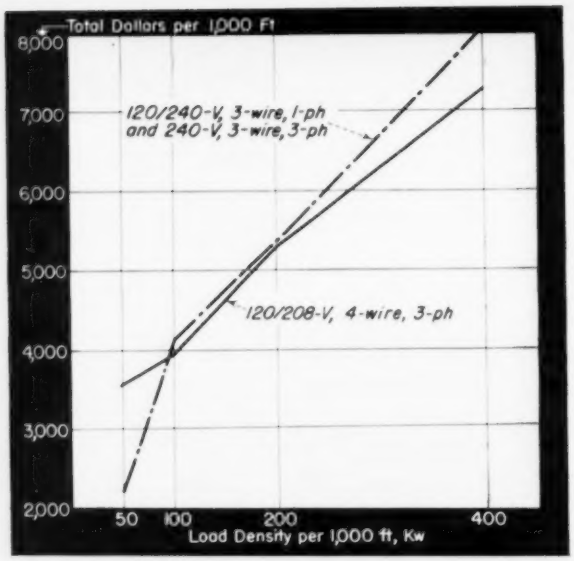
Line fuses and reclosers extend protection out on the circuits and isolate faulted sections. By sectionalizing, they help to overcome excessive circuit mileage. Self-protecting distribution transformers and banked secondaries reduce interruptions from the transformer failures. But building reserve capacity into a feeder does not improve its service reliability; it can only reduce the time required to pick up part or all of an adjacent circuit.

New circuits usually are developed by regrouping portions of several existing circuits. In this connection, reference to records of past troubles guides specifications for protection and the installation of reclosers or line fuses. It also determines where trees need special trimming or where rerouting or special construction should be used to avoid troublesome trees.

When Homes Have 3-Phase Loads . . .

4-Wire Bank Saves Money

M. N. BENNETT,
Asst. Electrical Engineer, Modesto Irrigation District, Modesto, Calif.



120/208-V SYSTEM REDUCES THE COST of separate light and power services for a wide range of load densities. The cost includes the transformers, secondaries, service drops, meters for 36 customers

Utilization voltages are a major factor in determining the economic design of secondary distribution systems. In areas of relatively light density new demands for 3-phase service (for air conditioning as an example) often require expensive changes in the system. But an increase even in the single-phase load can boost loading to a level where system changes are necessary. Costly rebuilding can be avoided only if the original system is planned to take care of these expansions.

Comparison of two methods of serving these mixed single-phase and 3-phase loads is presented in this article. The conventional method is to install a 120/240-v, 3-wire system for general use, supplemented where needed by 240-v, 3-wire, 3-phase installations. The alternative is the 120/208-v, 4-wire, 3-phase system.

Conditions assumed in this comparison are (1) overhead construction, (2) 1,000 ft of radial secondary, (3) 125-ft pole spacing, (4) 36 customers at four per pole, and (5) 60-ft services. Load densities per 1,000 ft are taken as 50 kw, 100 kw, 200 kw, and 400 kw. Within the 50-kw load density area, no 3-phase load is supplied. Within the 100-kw and 200-kw areas, 25% of the load is 3-phase. Within the 400-kw area, 37.5% of the load is 3-phase. These same ratios also determine the number of customers requiring single-phase and 3-phase services.

Location of 3-phase Customers Varies . . . The physical spacing of customers requiring both single and 3-phase service cannot be predicted. A distribution system must supply either or both voltages at any given location within the area. The 4-wire, 120/208-v, 3-phase system will meet these requirements. But the combination system, upon initial installation, is often designed to supply single-phase service throughout a load area and 3-phase service at known locations.

The combination system for this comparison is designed and costs determined on the basis of supplying either or both utilization voltages at any location. Single-phase transformers supplying the 120/240-v, 3-wire, single-phase secondary and 3-phase banks of single-phase transformers supplying the 240-v, 3-wire, 3-phase secondary are uniformly spaced along the 1,000-ft run. The most economical combination of conventional transformers and secondary conductors capable of maintaining a maximum of 3% voltage drop was used. The 4-wire system was similarly designed, using banks of three single-phase transformers uniformly spaced.

Installed costs of each system in each of the four areas were determined. These costs include transformers, secondaries, services, and meters. The table lists the comparative economic values within each load density area.

Based on report presented to California Inter-Utilities Underground Standards Committee

4-Wire System Cuts Installed Cost per 1,000 Ft of Secondaries . . .

Type of System	Load, Kw-1,000 Ft	Transformers	Secondaries	Services, 36 Custs	Meters, 36 Custs	Total
120/208Y-v 4-wire	50	$1,262.88	$475.39	$632.52	$1,152.00	$3,522.79
120/240-v 3-wire; No 3-ph	50	737.46	367.71	632.52	477.00	2,214.69
120/208Y-v 4-wire	100	1,570.68	475.39	678.24	1,242.00	3,966.31
120/240-v 3-wire; 25% 240-v 3-ph	100	1,818.62	735.42	790.64	765.00	4,109.69
120/208Y-v 4-wire	200	2,752.00	657.50	678.24	1,242.00	5,330.24
120/240-v 3-wire; 25% 240-v 3-ph	200	2,729.52	1,108.64	790.64	765.00	5,393.81
120/208Y-v 4-wire	400	4,325.32	973.02	703.64	1,292.00	7,293.98
120/240-v 3-wire; 37.5% 240-v 3-ph	400	5,071.22	1,245.22	878.50	925.00	8,119.94

8 reasons why
G. E. IS YOUR BEST
TRANSFORMER BUY
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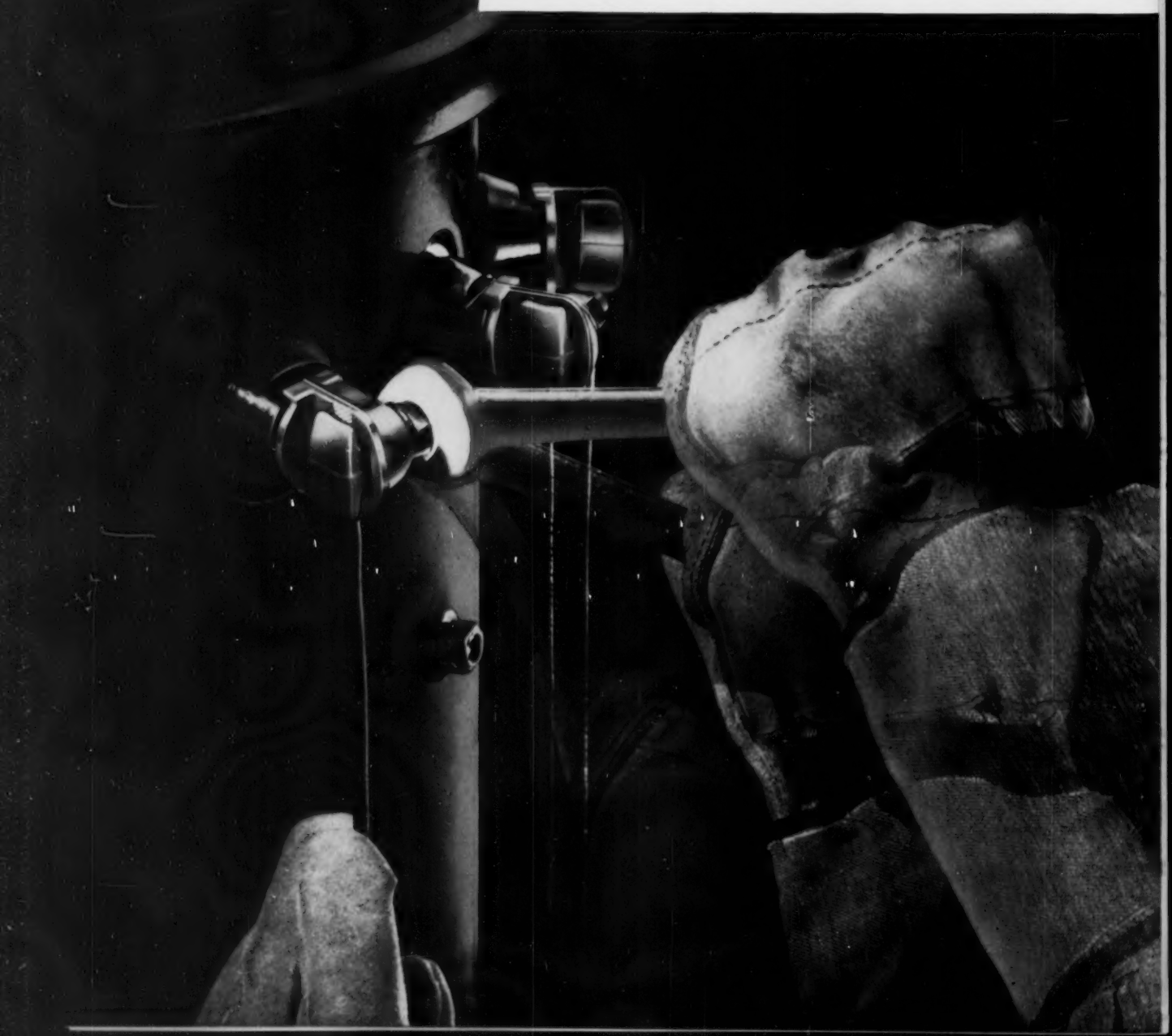
DISTRIBUTION TRANSFORMERS

Only General Electric offers

Strenicor pressure terminal clamps...

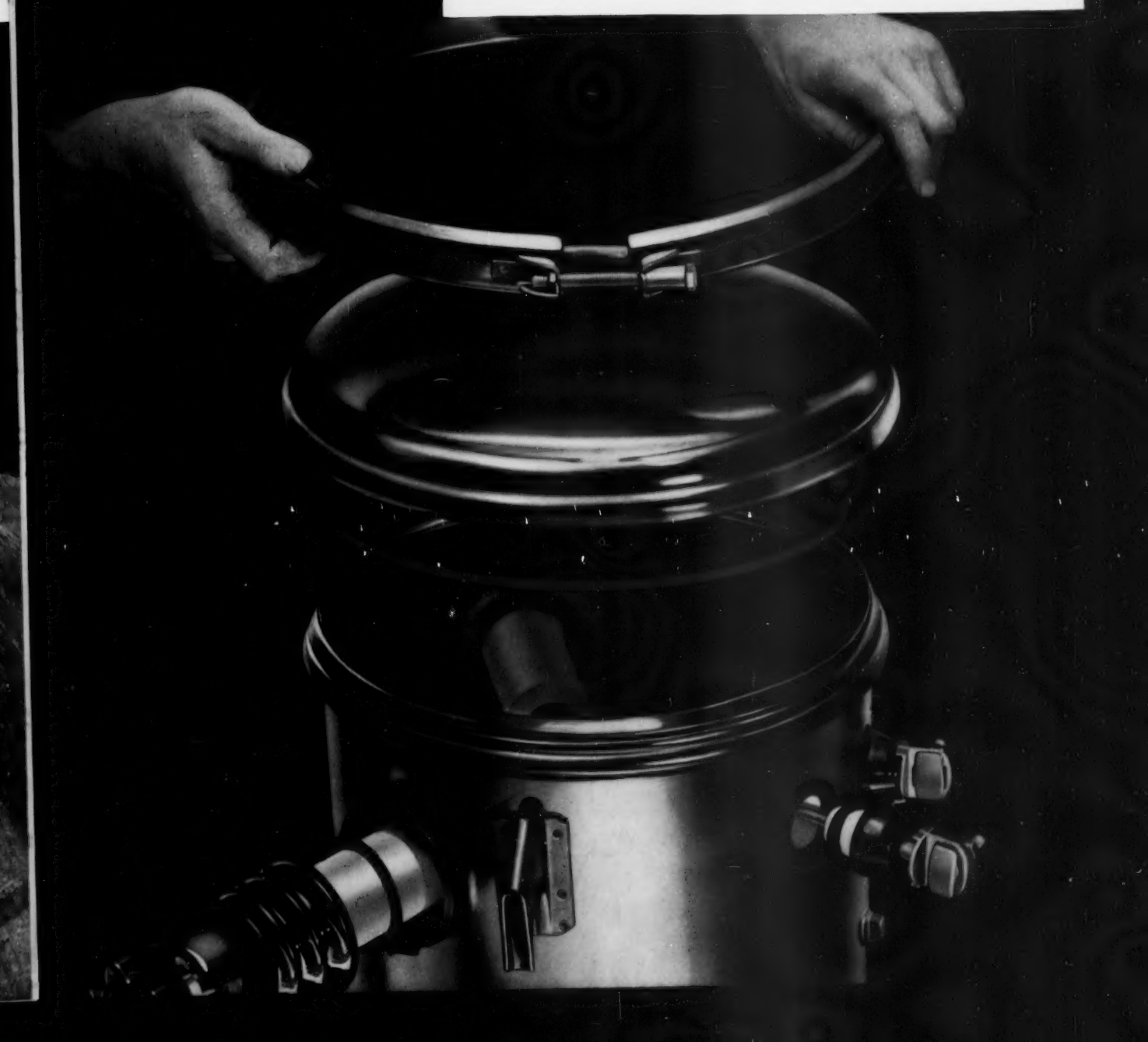
improve service continuity because they resist stress corrosion



DISTRIBUTION TRANSFORMERS

Only General Electric offers

Nitrile rubber gaskets . . . prolong life of the transformer by sealing out dirt, and by preventing tank breathing



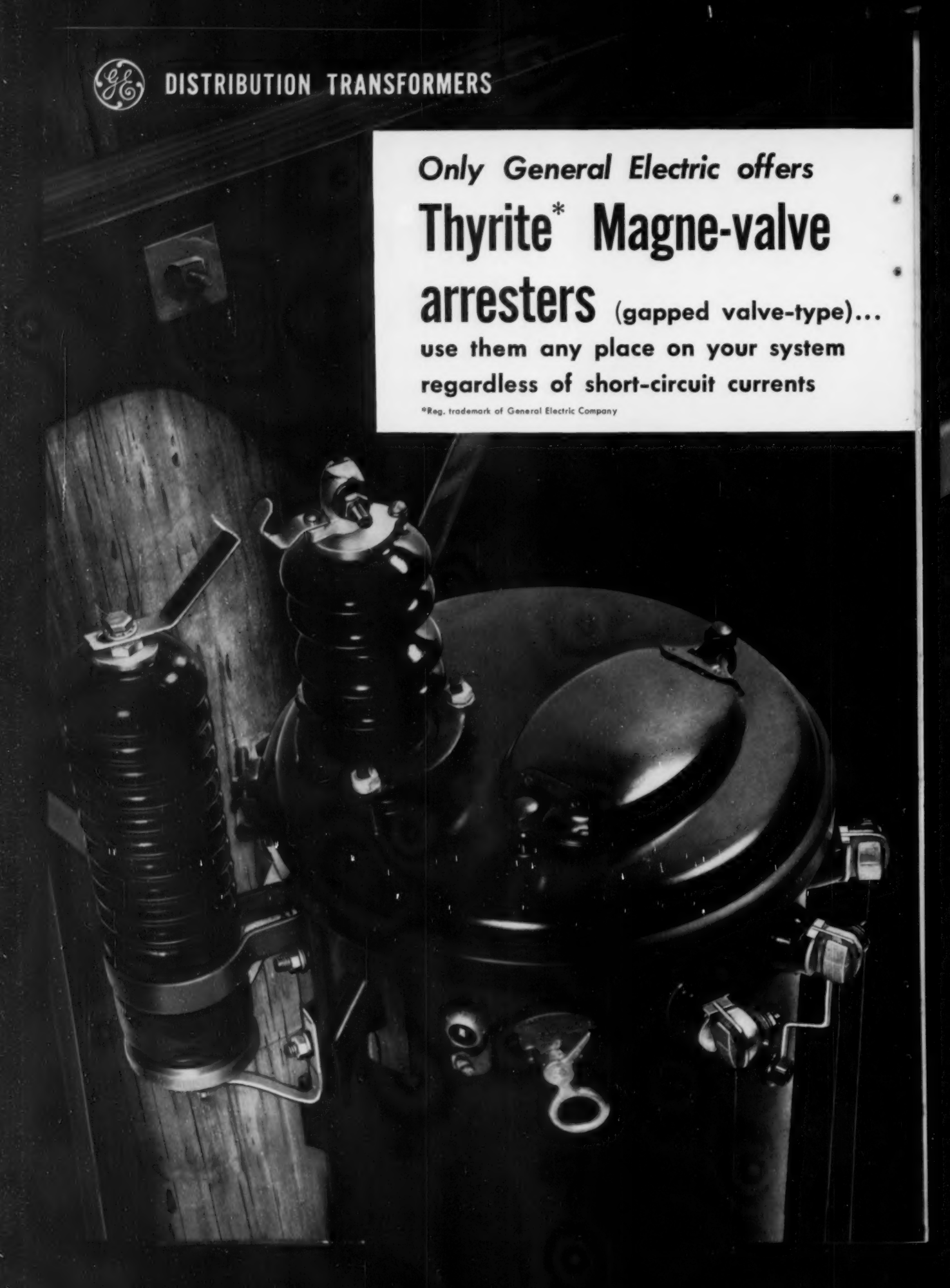
DISTRIBUTION TRANSFORMERS

Only General Electric offers

Thyrite* Magne-valve arresters (gapped valve-type)...

use them any place on your system regardless of short-circuit currents

*Reg. trademark of General Electric Company

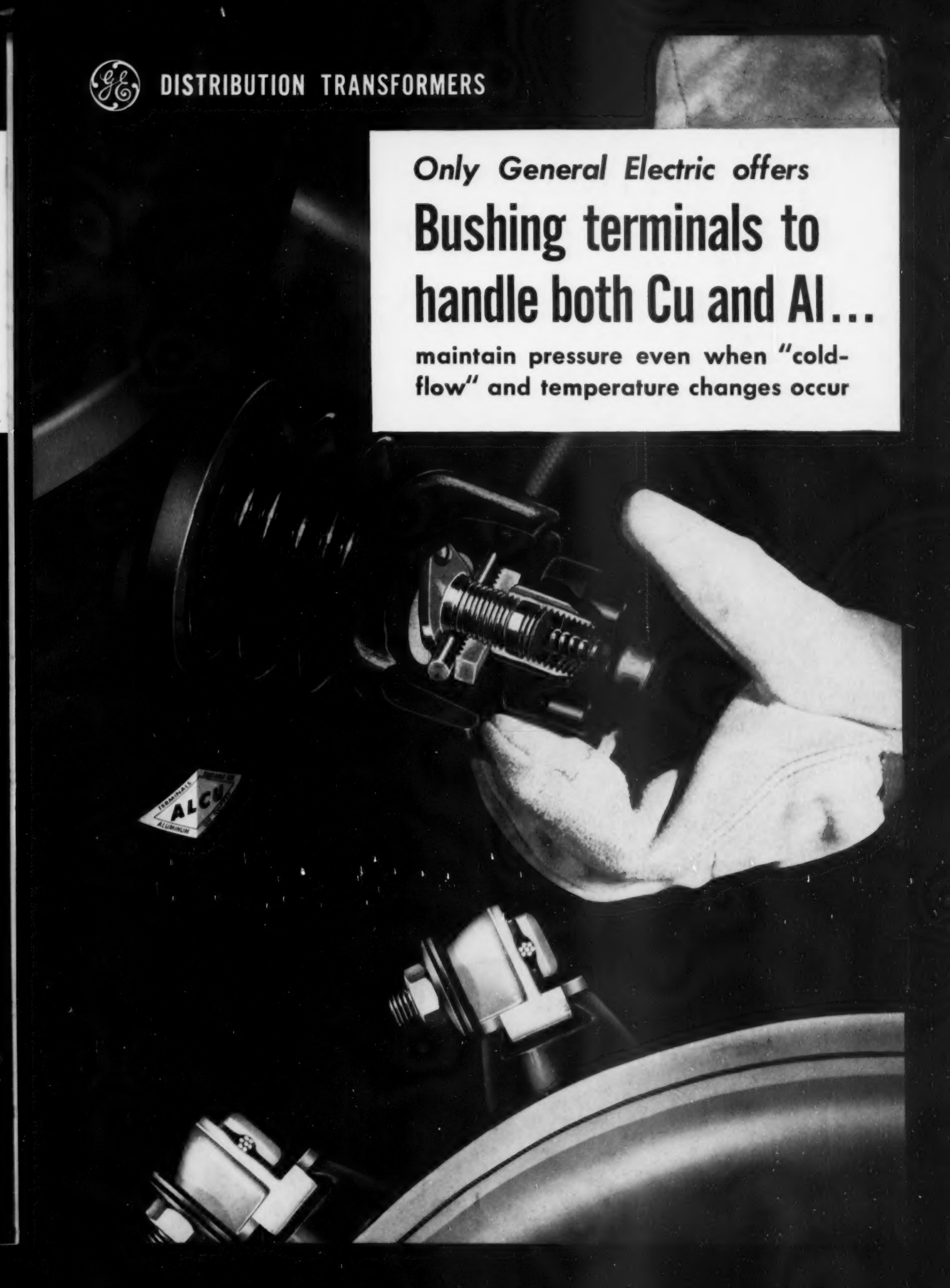


DISTRIBUTION TRANSFORMERS

Only General Electric offers

Bushing terminals to handle both Cu and Al...

maintain pressure even when "cold-flow" and temperature changes occur

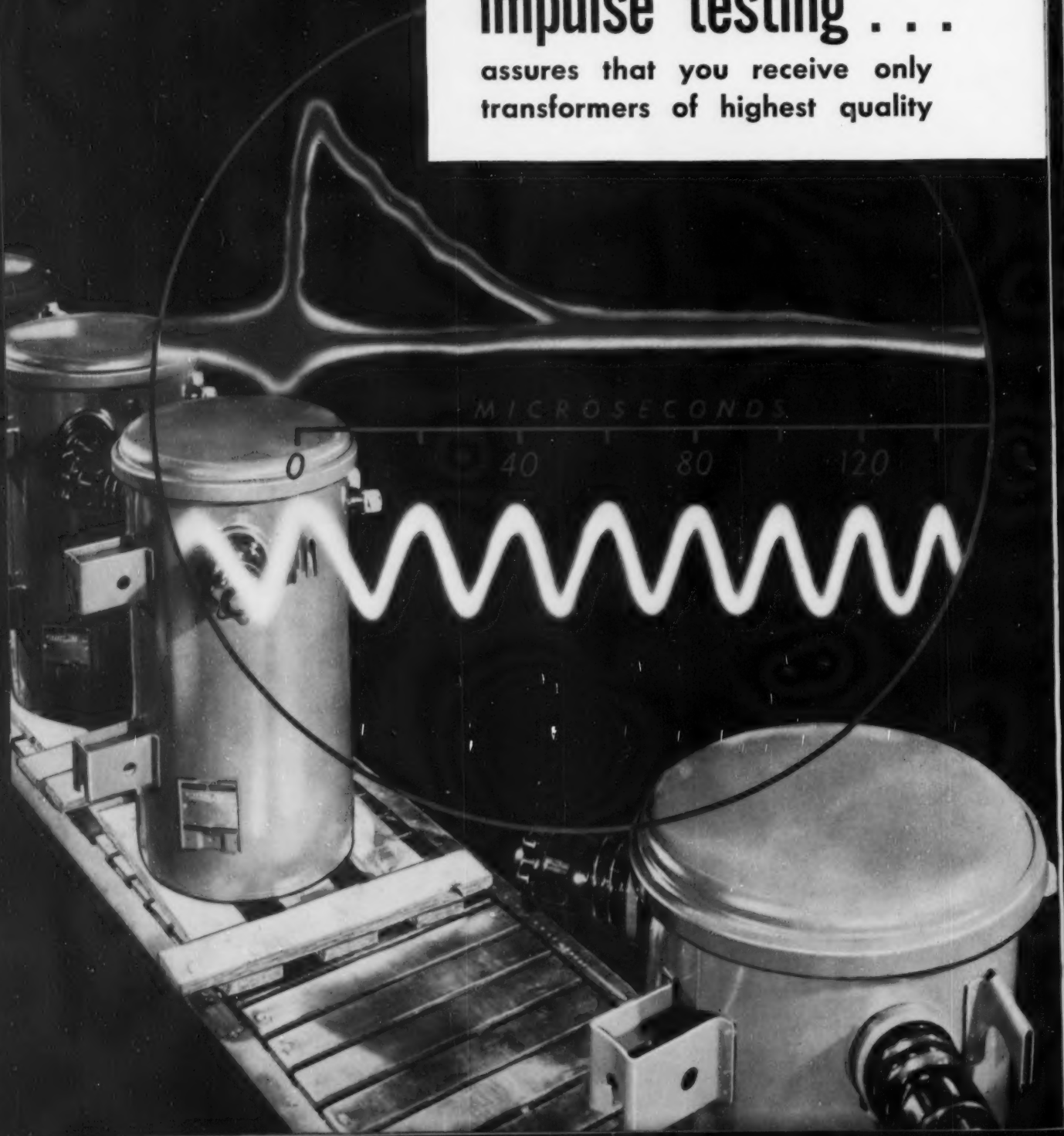


DISTRIBUTION TRANSFORMERS

General Electric offers

Production-line impulse testing . . .

assures that you receive only transformers of highest quality



FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Terminals designed for both copper and aluminum conductors	YES	NO	NO	NO	NO	NO
Production-line impulse testing	YES	NO	NO	YES	NO	NO
One-piece cover band	YES	NO	NO	NO	NO	YES
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	YES

Check these reasons why

G.E. IS YOUR BEST TRANSFORMER BUY

ONLY GENERAL ELECTRIC OFFERS:

1. STRENICOR PRESSURE TERMINAL CLAMPS improve service continuity because they resist stress-corrosion. With a high tensile strength of 107,000 psi and a yield strength of 83,000 psi, Strenicor terminals are practically immune to a failure by stress-corrosion. They virtually eliminate outages and resulting service calls and customer inconvenience caused by failure of secondary terminals.

2. NITRILE RUBBER GASKETS prolong transformer life because they prevent tank breathing. Used at all tank openings, the gaskets seal out dirt and moisture, thus prolonging the life of the insulation—and of the transformer. The gaskets require no cement, are usable again and again.

3. THYRITE MAGNE-VALVE ARRESTERS can be used any place on your system regardless of short-circuit currents. A gapped valve-type design, Thyrite Magne-valve arresters are small, light, and operate without any internal wearing away regardless of system short-circuit capacity or frequency of operation. This assures long service life.

4. BUSHING TERMINALS handle both copper and aluminum. Tin-plated to retard corrosion, the bushings maintain tight connections even if "cold-flow" and temperature changes occur. The new terminals handle both aluminum and copper without special fittings.

PLUS THESE EXTRA FEATURES:

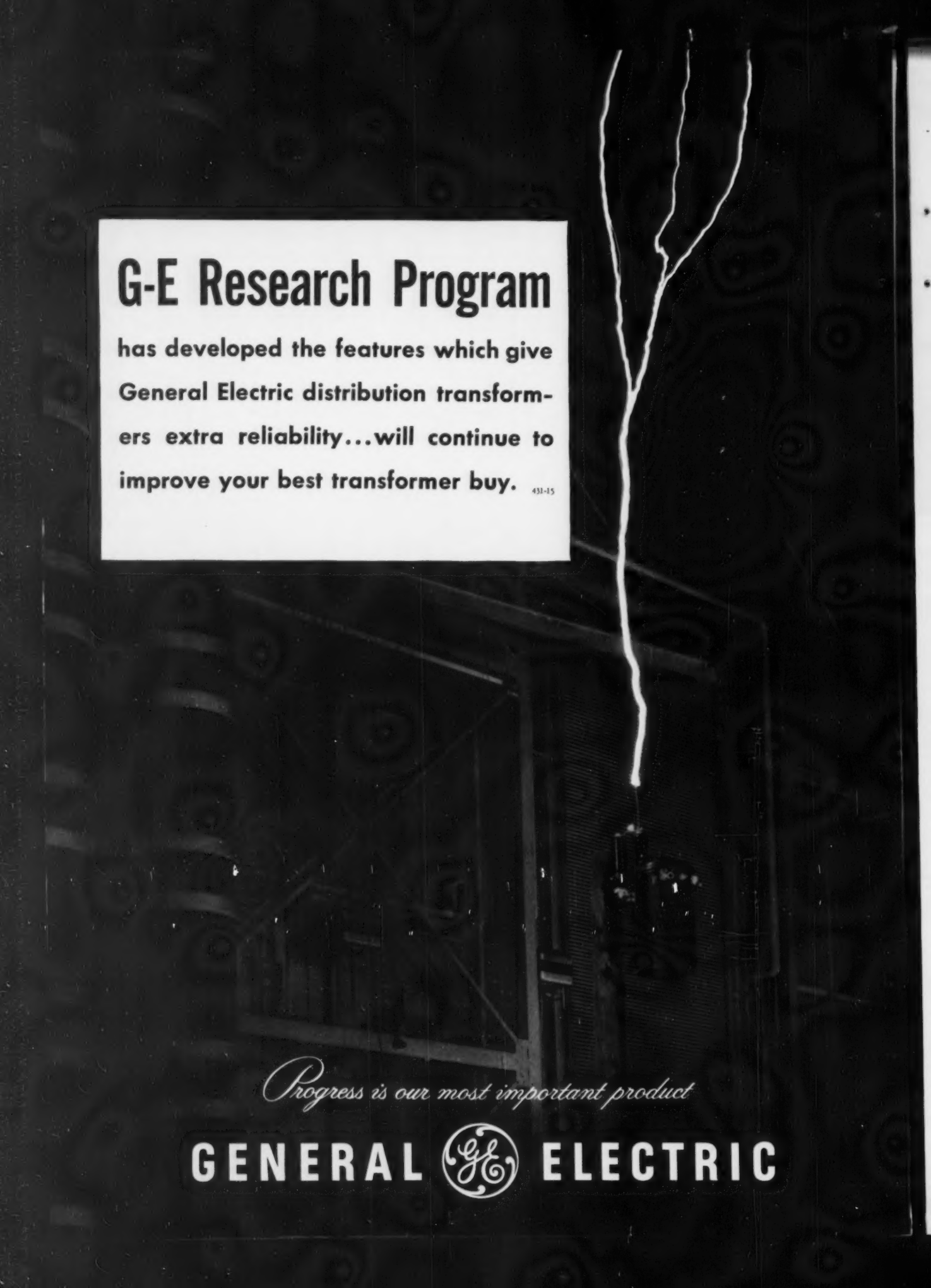
5. PRODUCTION-LINE IMPULSE TESTING assures you of extra years of service from your transformers. This test automatically picks out transformers which have passed all tests prescribed by the American Standards Association but which may still have minor weaknesses. You receive only transformers of the highest quality.

6. STAINLESS-STEEL ONE-PIECE COVER BAND prolongs transformer life and facilitates inspection. Exerting even pressure around rim of tank, the band resists corrosion and stays tight even after years of service. With a tight seal, purity of oil is safeguarded. Yet you need only a screwdriver to remove or replace band for maintenance.

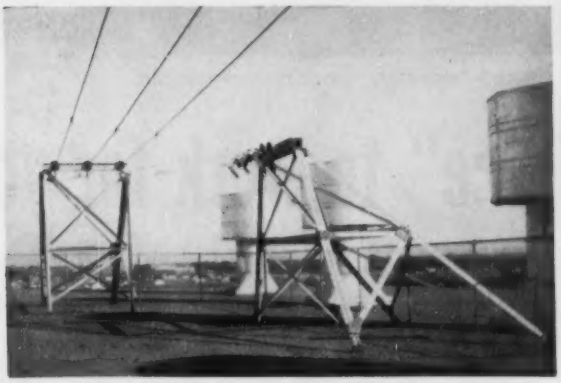
7. NATIONWIDE SERVICE FACILITIES assure you of fast help when a storm strikes—or when routine repair work piles up. Located at industrial centers from coast to coast, General Electric's 31 service shops are staffed by factory-trained personnel ready to give you fast, emergency service or to handle your routine repair work.

8. SUPER MELAGLYP saves you money by greatly reducing your repainting costs. A new paint finish that averages 50% longer life, Super Melaglyp gives you up to 150% more protection than finishes formerly used. General Electric Company, Schenectady 5, New York.

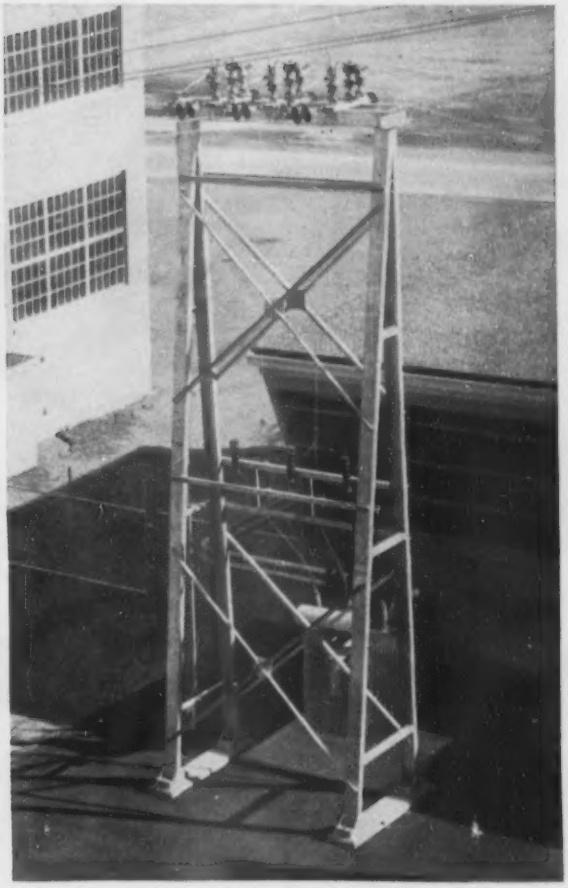
GENERAL ELECTRIC


G-E Research Program
has developed the features which give General Electric distribution transformers extra reliability...will continue to improve your best transformer buy. 431-15
Progress is our most important product
GENERAL ELECTRIC

EASE OF FABRICATION and handling of aluminum switching tower held total circuit down-time to less than 36 hr



EXTRUDED ALUMINUM angles and channels were prefabricated and assembled on the roof to provide supports for 12.5-kv lines



A-FRAME STRUCTURE of extruded aluminum was prefabricated and assembled horizontally before being set in vertical position

Extruded Aluminum for Switching Structures

R. N. PAGE,
Reynolds Metals Co, Richmond, Va.

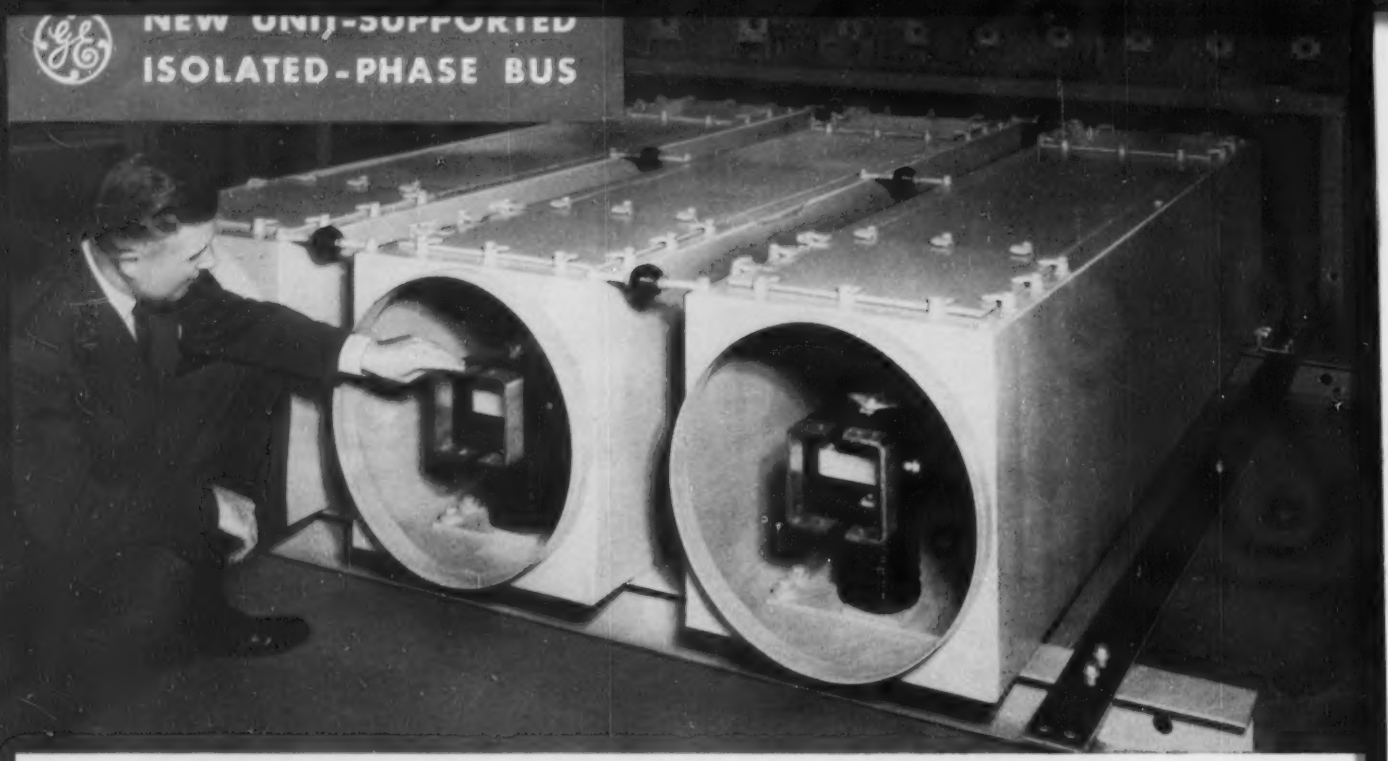
Strong, light-weight, extruded aluminum structural shapes have replaced former transmission and switching supports at Reynolds Metals Co's extrusion plant, Phoenix, Ariz. Ease of welding, fabrication, and handling; elimination of painting and maintenance; and resistance to corrosive industrial atmospheres offset the slightly higher initial cost of aluminum over other structural materials formerly used at Phoenix.

Main incoming switching structure carries six 12.5-kv, 336,400-cir mils ACSR stranded cables. Each conductor varies in tension from 3,070 lb at 30F to 1,400 lb at 120F. Two sets of single-pole, 1,200-amp, 15-kv, gang-operated disconnect switches are mounted on the structure. Suspension insulators are equipped with strain clevises held in place by the main-frame cross arms.

For a new installation, an entire aluminum frame work can be assembled in a horizontal position and set in place with a light yard crane. At Phoenix, horizontal cross arms were omitted initially to allow the structure to clear existing cables. Circuit down-time for the entire installation and change-over was less than 36 hr.

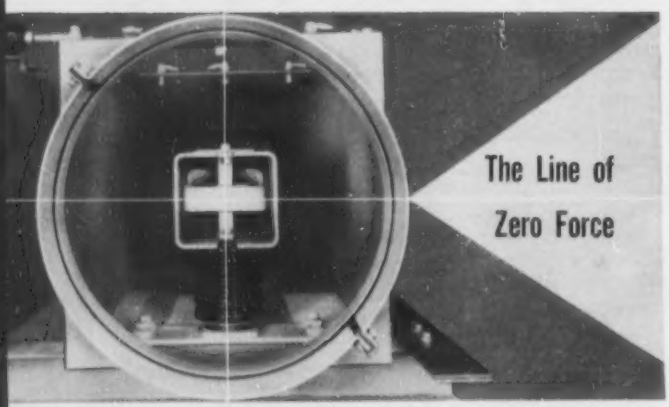
The aluminum tower is designed so that it may be raised to allow insertion of an additional section on the foundation pads when higher adjacent line supports are set in place later.

A-frame-type switch structures, carrying three 12.5-kv 266,800-cir mils ACSR stranded cables, were all prefabricated and assembled horizontally before being positioned. Where it was necessary to carry power lines over the building, extruded aluminum angles and channels were prefabricated and supports were assembled in position on the building roof.



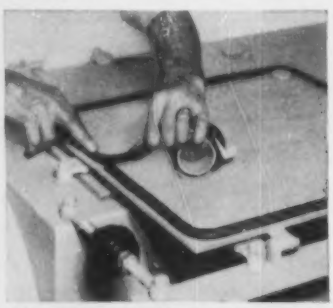
NEW UNIT-SUPPORTED bus withstood 350,000 amperes momentary during fault-current test.

Now G.E. puts "Zero Force" to work for you



HEART OF THE "ZERO-FORCE" DESIGN is the single insulator support. It is positioned in center of conducting sheath where eddy currents help cancel fault-current stresses.

STURDY INSULATOR BRACES prevent circulating currents between housings. They are adjustable for initial lineup.



AIR-TIGHT GASKETING is accomplished with an easy-to-apply tape having a fibreflex core. Note simplified hardware on hinged cover.

New design of isolated-phase bus reduces stress forces, needs less maintenance

General Electric's new Unit-supported, Isolated-phase Bus needs only one insulator at each support point. This minimizes the chance of insulation failure and reduces over-all weight for easier installation.

Exhaustive tests prove that ample conductor-support depends not on the number of insulators, but on their placement. G.E.'s new design places one insulator near the center of the sheath where the conductor experiences zero net force during short-circuit currents, thus enabling the bus to easily withstand fault-current stresses.

Here's how design-simplification "pays off" for you:

Reduced maintenance—One insulator means your inspection time is cut in half; the possibility of insulation failure minimized. Insulator-access covers are shorter, less bulky—make inspection easy.

Easier installation—New bus weighs 13% less for easier handling. There is no piecemeal assembling because you can receive completely assembled three-phase units in sections up to 16 feet long.

Co-ordinated design—Co-ordination with station components is an integral part of the G-E design. Phase isolation is assured in all connections with station equipments.

For more information on this stronger, lighter Isolated-phase Bus, contact your General Electric representative or write for publication GED-2237, General Electric Company, Schenectady 5, New York.

501-2

GENERAL ELECTRIC

Oil Circuit Breaker Contact Resistance

Contact resistance in microhms for the respective breakers and current ratings are considered the maximum allowable. Listings are adapted from presentations at Doble Clients Conferences

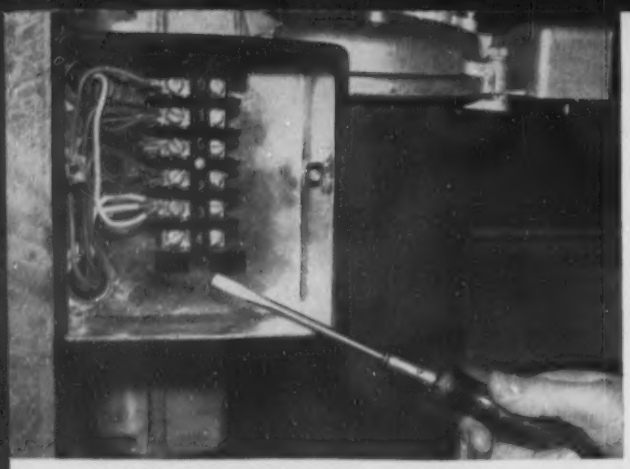
Breaker Type	Amp	Res.,[c] μ ohms
5 KV		
AM-5-100 & 150	600	100[a]
AM-5-200	2,000	50[a]
AM-10-10	600	50[a]
AM-10-10	1,200	50[a]
B-20	800	250[a]
HJ[e]	1,200	100[a]
HJ[e]	2,000	50[a]
HM & HV	2,000	50[a]
HV-100	1,200	75[a]
HV-150	2,000	50[a]
5-HV-100	1,200	75[a]
5-HV-150	1,200	75[a]
5-HV-150	2,000	50[a]
50-DH-150	600	100[a]
50-DH-150	1,200	75[a]
50-DH-150	2,000	50[a]
50-U-20	1,200	100[a]
B-13[f]	600	100[a]
15 KV		
AB-15-25	600	150[a]
AM-15-250-1	1,200	50[a]
B-7A	2,000	50[a]
CO-11 & 111	1,200	150[a]
D-13B & C	600	200[a]
D-17B	800	250[a]
DR-40	1,200	100[a]
DR-60[d]	1,200	100[a]
F-8	600	200[a]
F-105	2,000	75[a]
F-120	600	200[a]
FH-6	600	300[a]
FH-203	600	300[a]
FH-206	600	200[a]
FH-206	3,000	30[a]
FH-209	2,000	50[a]
FHB-123	600	300[a]
FHB-123	1,200	100[a]
FHB-126	2,000	50[a]
FHB-126	3,000	40[a]
FHB-129	3,000	40[a]
FHK-130-20B	600	300[a]
FHK-130-20B	1,200	100[a]
FHK-130-28B	3,000	50[a]
FHK-230-20B	600	300[a]
FHK-230-28B	3,000	50[a]
FHK-330-20B	600	300[a]

Breaker Type	Amp	Res.,[c] μ ohms
15 KV (cont.)		
FHKO-139-24AS	2,000	75[a]
FHKO-139-24BS	800	300[a]
FHKO-139-24BS	1,200	200[a]
FHKO-139-36CS	4,000	40[a]
FK-53B[d]	2,000	50[a]
FK-230-16A	600	300[a]
FK-330-16A	600	300[a]
FK-339-14.4-300	2,000	75[b]
FK-339-15-1000-1	3,000	50[b]
FK-339-1500	2,000	50[a]
FK-339-1500	4,000	40[a]
FK-439-14.4-1000	1,200	250[b]
FKR-132B	600	200[a]
FO-40A	600	200[a]
FO-40A	1,200	150[a]
GO-3	600	200[a]
GO-4A	3,000	40[b]
GO-5A	4,000	35[a]
O-241	600	200[a]
O-331	2,000	75[a]
U-Deion	600	200[a]
Y-1[d]	2,000	50[a]
150-CA-1000	3,000	40[a]
150-CA-1500	4,000	25[a]
150-CA-2500	5,000	15[a]
150-DH-250	1,200	75[a]
150-U-12 & 22	600	100[a]
150-U-22	1,200	75[a]
150-U-37	2,000	50[a]
150-U-37	3,000	40[a]
25 KV		
FKO-136-1026AS	400	400[a]
FKO-136-1026AS	800	300[a]
G-1	400	600[a]
GO-2[g]	1,200	150[b]
O-241	1,200	150[a]
O-241	2,000	100[a]
O-331-S	2,000	75[a]
34.5 KV		
ABO-34.5-1000	1,200	150[a]
AR-30-1000	1,200	350[a]
FK-339-1500	1,200	100[a]
FK-339-1500	2,000	50[a]
FHKO-39-32BS[h]	400	500[a]
G-11[h]	600	200[a]

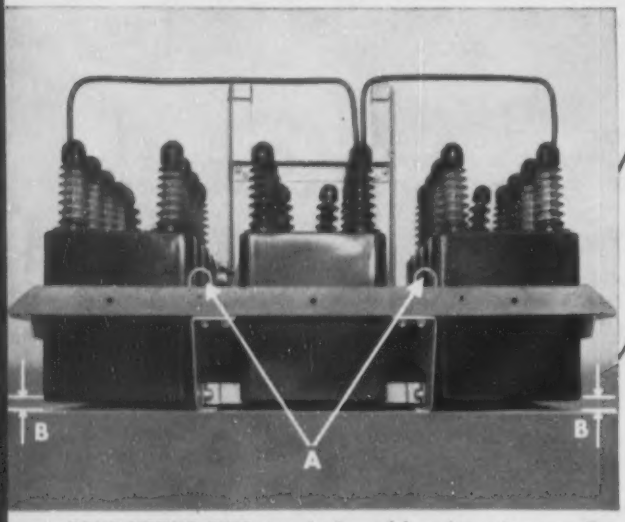
Breaker Type	Amp	Res.,[c] μ ohms
46 KV		
FK-339-1000	1,200	700[b]
FK-339-1500-5	1,200	700[b]
FK-439-1500	1,200	500[b]
FZO-50-46D & FS	1,200	500[b]
FZO-150-46F	1,200	500[b]
GO-1, 1A, 2 & 2A	600	700[b]
GO-4	1,200	500[b]
69 KV		
FK-339-1000	600	500[b]
FK-439-1000	600	500[b]
FK-439-2500	1,200	500[b]
FZO-50-69D	600	500[b]
FZO-151-69D	600	500[b]
FZO-151-69F	1,200	500[b]
GM 6	2,000	75[b]
GM 6A	2,000	100[b]
GO-3B	600	300[b]
GO-4B	1,200	300[b]
GO-5A	1,200	150[b]
115 KV		
FHKO-339-54B-F2	600	500[b]
FHKO-339-60C-F2	600	500[b]
161 KV		
BZO-60-J	1,200	1,000[b]
BZO-160-J & K	1,200	1,000[b]
FGK-10000	1,200	500[b]
FHKO-39-72B-F4	1,200	700[b]
FHKO-139-72B-F4	1,200	1,000[b]
FK-339-2500, 3500	1,200	1,000[b,i]
FK-439-3500, 5000	1,200	1,000[b,i]
GM-3 & 4	1,200	700[b]
GM-5	1,200	500[b]
GO-2A (1.5 mva)	1,200	800[b]
GO-2A (5 mva)	1,200	500[b]
GO-3A (2.5 mva)	1,200	800[b]
GO-3A (5 mva)	1,200	500[b]
RWE-64 & 78	1,200	900[b]
187 KV		
FHKO-139-114CY	1,000	500[a]
G-222 & 222S	1,000	350[a]
230 KV		
FHKO-239-108CY	1,000	500[a]

a. Values determined by Philadelphia Electric Co using the "Ducter" for majority of tests.
b. Values determined by Tennessee Valley Authority using the "Microhmer" for majority of tests for contact resistance.
c. Values are for closed oil circuit breakers. When test readings are greater than these listed values, breakers should be investigated.
d. Circuit breaker contacts are silver plated.
e. 4.16kv f. 7.5kv g. 23kv h. 37kv
i. 2,000 microhms acceptable only for lightly loaded breakers

You'll find all

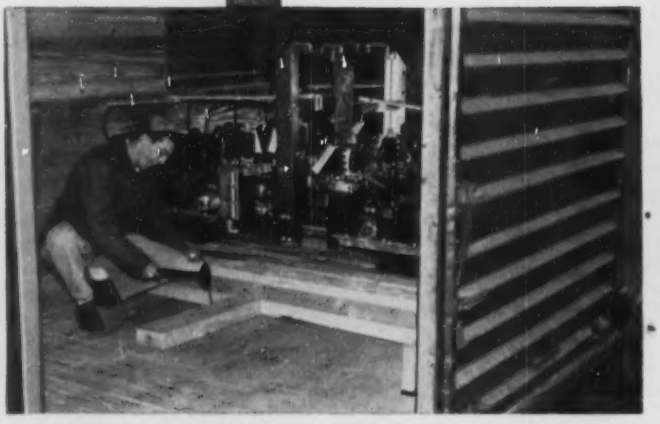


ROOMY TERMINAL BOX, easily accessible, allows plenty of working space for making connections to numbered, clamp-type terminals. Two 1-inch knockouts in bottom provide openings for leads.



FOUR LIFTING EYES, two in front (a) and two in rear, eliminate need for spreader bar; equipment lifts level for easy mounting on pole. Skids provide clearance (b) to prevent scraping bottom of units.

HEX-HEAD CAP SCREWS secure switches and units to frame and simplify removal for maintenance. Three units can be substituted for the switches, making a 375-kvar fixed bank.



SHIPPED ASSEMBLED, in carload shipments, ready to hoist into position upon arriving at the pole. All that needs to be removed is the pallet which is attached with four bolts.

the features you want in new G-E Auto-switch Capacitors

New design helps to simplify installation, speed maintenance; and gives you increased flexibility, more economical service

Based on the suggestions of electric utilities, actual field experience and G-E studies, here are the features you'll need to make your auto-switch capacitor installations easier, increase their flexibility and reliability and cut maintenance problems:

FOR EASY INSTALLATION we've provided skids to protect units from damage, simplify and speed handling; four lifting eyes to facilitate hoisting; ample terminal box with knockouts to simplify control connections; holes for mounting auxiliary equipment, such as lightning arresters, directly on the equipment; and grounding terminals on either side of the frame.

FOR FLEXIBILITY and low maintenance we've included: tapped mounting holes to make it easier to replace switches and units; arranged mounting so that additional capacitors can be substituted for switches, potential transformer or arresters can be mounted on racks and shipped as part of equipment, and so that capacitors and single-phase switches of all major manufacturers can be used interchangeably. In addition we've made the new equipment reconnectable from delta to wye, using the same cable; and made possible the mounting of a single equipment, direct-to-pole, or two equipments side-by-side on the same crossarm.

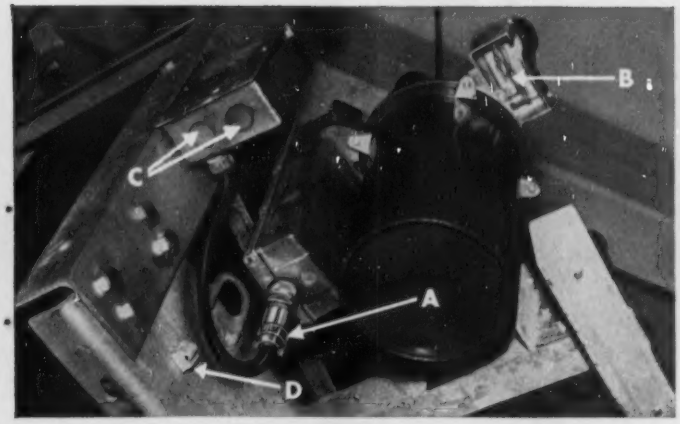
FOR MAXIMUM RELIABILITY we've standardized on capacitors filled with Universal Pyranol* dielectric; heavy-gage hot-dipped galvanized racks to help avoid handling damage, distortion, and minimize corrosion; 5-kv Flamenol* insulated cables and rubber bird caps; and uniform striking distance between bushings of different potential.

This is only a partial listing of the user-convenience features of G-E Auto-switch Capacitors. For complete information, contact your G-E Apparatus Sales Representative. *General Electric Company, Schenectady 5, New York.* 441-12

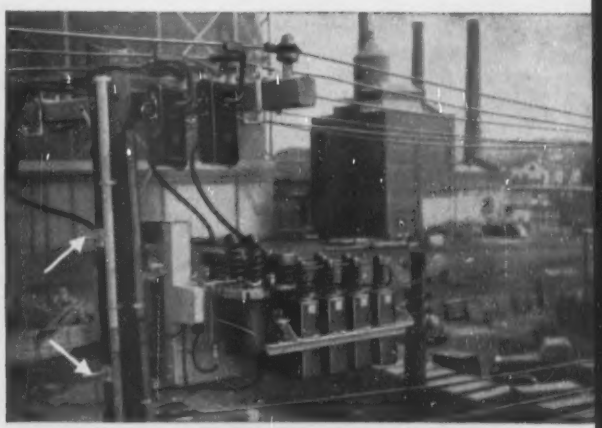
*Reg. Trade-mark of General Electric Co.

Progress is our most important product

GENERAL ELECTRIC



BOTTOM VIEW shows plug-in connector (a). Manual operating handle (b) on switch is readily accessible. Note two knockouts (c) in terminal box. Ground terminal (d) can be on either side of frame.



DIRECT-TO-POLE MOUNTING, an optional design, with two through-bolts (arrows) eliminates need for extra crossarms and makes possible installations on over-crowded poles.

Electronic Phone Good for High-Noise-Level Locations

ROBERT L. MAYER,
Communications Engineer, Pacific Gas & Electric Co, San Francisco, Calif.

Value of an electronic telephone for use in high noise-level locations without the need for noise-reducing shields or booths was proven in tests conducted by Pacific Gas & Electric Co. When using this new type of phone, operators may stand at their operating positions and observe instrument dials or lights or make adjustments while communicating with other parts of the plant or system. The electronic device is equally applicable to common battery magneto and dial systems. Thus it may be connected to interplant phone systems and to outside open-wire or long-line carrier communications systems.

Reduction of transmitter sensitivity is the secret of successful operation of the electronic phone. The device incorporates two 12AX7 and one 12AU7 vacuum tubes and full-wave selenium rectifiers. In physical appearance it is almost identical to a standard telephone hand set. Receiver and transmitter gain controls and an additional "side tone" balance control are provided in a recessed portion of the instrument base. Controls may be adjusted readily without disassembly or modification of the instrument. A single pair of wires connect the device to any normal telephone circuit. A 110-v, 60-cps cord and bayonet plug are provided to supply the electronic components.

The phone may be used without any difficulty by anyone. Operations such as switchboard supervision, metallic line ringing, line-to-ground ringing, and harmonic or selective ringing may be done without auxiliary switches or pushbuttons.

Another use of the instrument became apparent during the field tests . It may be used as a terminal repeater on long-wire lines where residual and induced electrical interference generally makes communications somewhat difficult. Adjusting the transmitter output for desired gain is all that is necessary. Measurements indicated that a signal-to-noise ratio advantage of about 10 db was available when using the instrument as a repeater. Somewhat higher overall loop gains were available when the instrument was used on either end of a long and noisy wire line.

Use of the instrument as a repeater, plus operation in noisy locations, warrants installation even though the cost is higher than a standard telephone set. To increase component life and reduce unwarranted failure, heater voltages and current ratings have been chosen carefully.

NEW ELECTRONIC TELEPHONE permits operator in noisy areas to communicate with other parts of the station

Electronic Phone Has These Characteristics:

Frequency Response	300-4,000 cps, ∓5 db
Transmitter gain over input	81 dbm
Receiver gain over line input	29 dbm
Common circuit impedance	600 ohm
Nominal circuit output into balanced 600-ohm line as terminal repeater	+11 dbm
Power supply	105-125 v, 60 cps
Power consumption	12 w

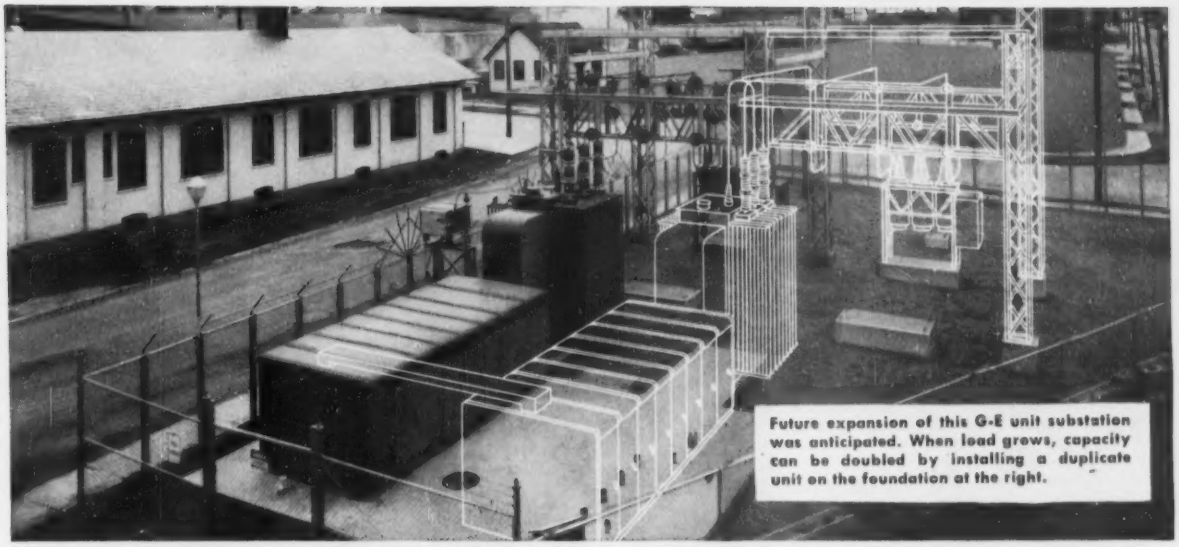
CUTTING ALUMINUM ANGLE, 4 x 4 in., is accomplished at less cost with this radial saw that is mounted on an adjustable saw arm

Radial Saw Reduces Fabrication Costs

N. W. CURTIS
Electrical Construction Foreman, Pennsylvania Power & Light Co, Allentown, Pa.

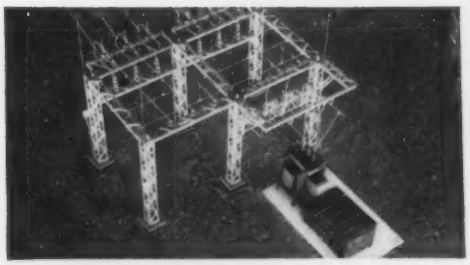
Pennsylvania Power & Light Co finds that a portable radial saw performs the same functions as an electric hack saw in fraction of the time and with less initial cost. Radial saw is valuable for fabrication of aluminum or copper bus and details. By selecting proper blade, saw will cut wood, copper, aluminum, or steel.

Radial saw that PP&L is now using consists of a port-

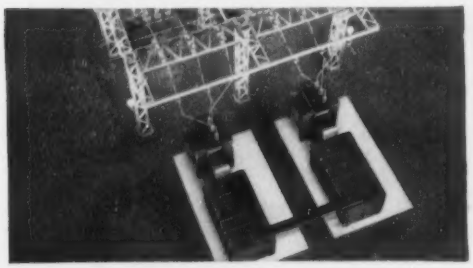


Future expansion of this G-E unit substation was anticipated. When load grows, capacity can be doubled by installing a duplicate unit on the foundation at the right.

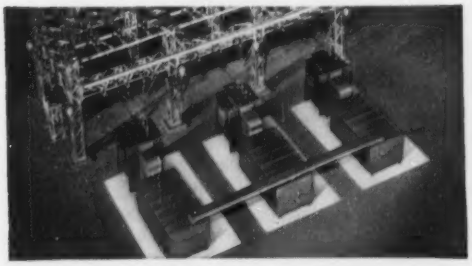
This General Electric substation is designed to grow with your load



1954 Single unit is installed, but load growth is anticipated and additional steel structure is also installed at this time.



1956 Capacity doubled to meet load growth. Bus tie provides emergency interconnection to restore service in case of outage on high side.



1958 Capacity tripled as load growth continues. Low-voltage-selective arrangement provides service continuity in emergency.

And with this arrangement, it's easy to—

1. **double or triple capacity by adding duplicate units**
2. **add additional "match and line-up" feeders**
3. **make connections to the high-tension structure**

General Electric unit substations make it both easy and economical to supply growing loads. By adding capacity in small units, as shown at the left, utilities avoid investing in overcapacity which will not be used for years—and which may never be used.

With G-E unit substations, it's easy to increase capacity by simply adding additional units. In this low-voltage selective arrangement, a bus tie with normally open tie breaker provides an emergency interconnection between the low-voltage sides of two or more individual substations. This permits restoration of service following an outage of either a transformer or high-voltage circuit.

Additional "match and line-up" feeders can easily be added to this design because the ends of the switchgear are accessible—not bottled up as in the case of double-ended substations. Additional match and line-up feeders will be available from the factory for years after the original equipment was purchased.

Standard high-voltage steel structure is another factor in easy expansion. It's easy to add to the structure if more lines are brought in, or if more units are added.

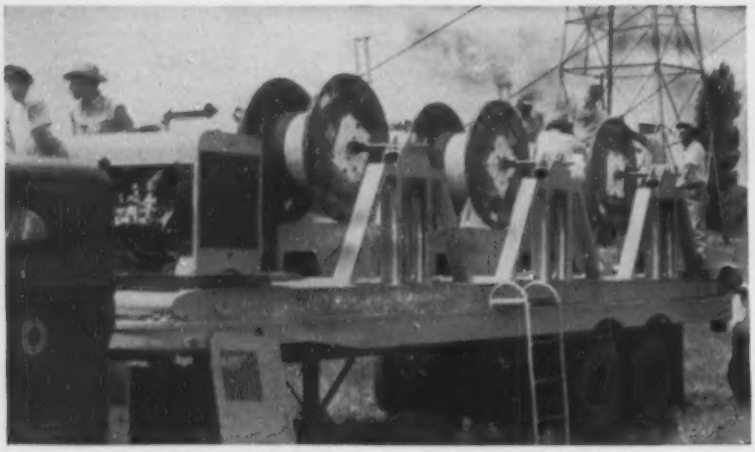
For further information about unit substations that provide easy expansion with a bonus in service continuity, ask your G-E apparatus representative for bulletins GEA-3800 and GEA-5847 or write to General Electric Company, Schenectady 5, New York. 512-2

GENERAL ELECTRIC

able electric hand saw mounted on a saw arm as illustrated. By sliding saw along the track, work up to 20 in. wide can be cut. Depth of cut is controlled by adjustment on pedestal of saw arm.

Saw is set up on a collapsible stand which can be disassembled and packed for transfer from job to job. By using a jig on the bench, duplicate cutting operations can be set up on production basis.

Reconductoring Equipment Pays for Itself on First Job



RECONDUCTORING TWO CIRCUIT MILES of steel tower transmission in a day was accomplished with this machine

PAUL R. CRITZER, General Foreman, Steel Tower Section, Cleveland Electric Illuminating Co, Cleveland, Ohio

A reconductoring machine enabled Cleveland Electric Illuminating Co to reconductor 350 wire miles of line with savings that more than offset the cost of the machine.

This machine was developed at the instigation and under the supervision of the company's personnel. Consisting of three, power-driven, wire reels mounted on a trailer, the equipment has also enabled the company to reconductor two circuit miles of steel tower transmission line in a day. Here, existing 4/0 copper was used as a bull line to pull in 795 MCM, 36/1 ACSR.

The machine is designed to pull one mile of line per hour at reel speeds of about 9.9 rpm on each of three reels. An operating range of from 3.3 to 9.9 rpm has been provided with intermittent high speed of 12 rpm. Torque at any speed is sufficient to exert a pull of 2,000 lb continuously and 3,860 lb intermittently on each line being pulled.

Three line reels are provided so that three wires of a circuit can be pulled simultaneously. Each reel is equipped with an individually controlled hydraulic elevator and is designed to handle reels up to 8,000 lb in weight, 45 in. in width, and 72 in. in diameter.

Each reel is linked to a main power shaft by a clutch with a torque rating of 710 lb-ft at 100 rpm.

Shaft is driven by an engine equipped with controls, governor, radiator, housing, etc. The power unit operates, under reeling conditions within a speed range of from 800 to 2,400 rpm with attendant horsepower of 27 to 80 and a torque of 176 to 180 lb-ft.

The entire machine is mounted on a 32-foot tandem axle, heavy-duty semi-trailer having vacuum-hydraulic brakes. Hold down eyes secure equipment in place. Constructed of structural iron and decked over with safety floor plate, the machine base is designed to be removed from the trailer as a unit if required.

A winch driven by the power plant and complete with 300 feet of ⅝-in. cable, capacity 15,000 lb, is also mounted on the trailer.

Automatic Recorder Aids Load Dispatcher

F. M. IRISH,
Superintendent, System Operations, Arizona Public Service Co, Phoenix

An automatic duel recorder in the load dispatcher's office at Arizona Public Service Co contributes to more efficient operation during the sending and receiving of messages. During severe system disturbances, when orders and information must be recorded quickly, the recorder may be connected to various communication circuits. This relieves the dispatcher of the strain of writing complete messages and details.

The recorder gathers information more accurately, which is a great help in subsequent analysis of system trouble. A microphone and long cord attached to the recorder are especially advantageous for dictating a record of switching over the supervisory system. The recorder is equipped with play-back devices. Recordings of messages received during disturbances are played before district and generating station personnel to help them develop clear-cut and concise methods of reporting, especially over the company's radio system. It also serves as a dictating machine for the load dispatcher.

The dual recorder is mounted in back of the load dispatcher's desk for convenience in changing disks and in play-back of recordings. Two recorders are used. The second is on standby and starts automatically when the first record is completed. On both units, a voice relay starts the disk rotating and stops it after a few-seconds pause in conversation. This eliminates the need for listening to dead-space during play-back.

By means of ten push buttons controlling a rotary selector switch, connections are made to three radio cir-

(*Continued on page* 172)

Revere Extruded Shapes help increase ELECTRIC GENERATOR OUTPUT

(perhaps you, too, could use our shapes to your advantage)

Model section of G.E. direct-cooled rotor for turbine-generator. Note intake scoop at left front, hollow copper conductors of extruded shapes, in center, exhaust outlet at right rear.

Insert shows typical extruded shapes after milling by G.E. to provide circulation of hydrogen throughout the field coils.

Winding temperatures are an important limitation upon the output of electric utility generators. They must be kept within safe limits to avoid damaging the insulation. Hence all generators have some method of cooling. Conventionally, the heat passes from the copper conductors in the rotor, through the insulation (which presents a formidable barrier to heat transfer) to the steel parts of the rotor body, and air or hydrogen is pumped through and around the rotor. It was realized long ago that more effective cooling could be obtained if some way could be found to remove the heat directly from the rotor coils.

Some years ago generator engineers of the General Electric Company, Schenectady, New York, proposed making each turn of the rotor coils of two copper extruded shapes; one a channel, the other comb-like. Fitted together, they would make hollow passages for the hydrogen, which would be taken in through scoops on the surface of the rotor, and exhausted through outlets some distance away, also on the rotor surface. In that way, the rotor could be quite uniformly and more effectively cooled throughout its length, and output greatly increased in relation to the physical dimensions of the generator.

An important problem was found in the extruded shapes. Design requirements had to be adjusted to the opportunities and practicalities of the extrusion process. Today these copper shapes, 20 feet long, drawn and finished to strict specifications as to dimensions and straightness, are making it possible to remove four times as much heat as conventional systems, and to double the generator output with no increase in size... For full information on extruded shapes, see the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

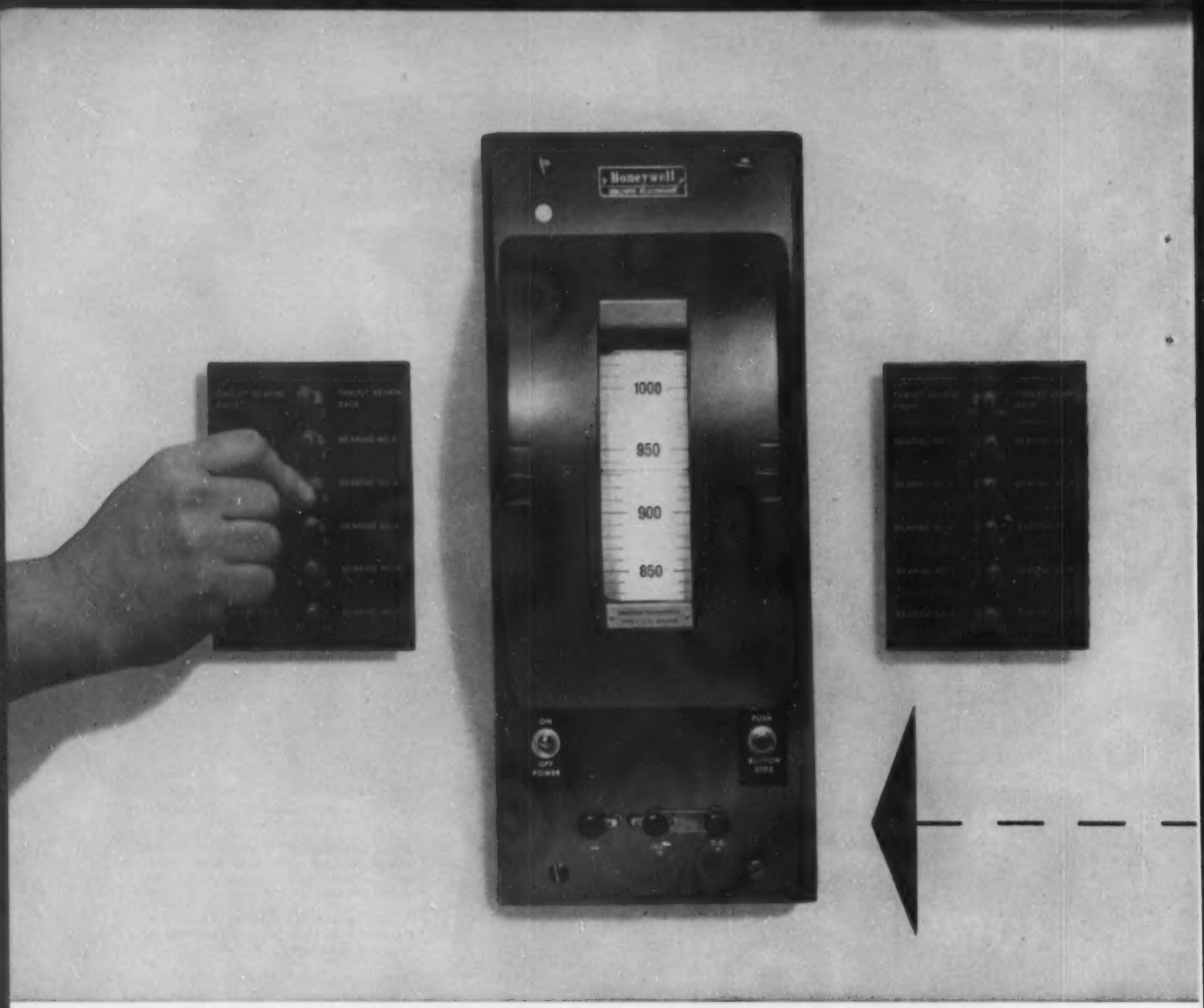
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS



Look at these features!

compact case
approximately 6½ inches wide by 15⅜ inches high

easily-read drum scale
rotates vertically; graduated length 28⅝ inches provides big, legible scale divisions and numerals.

accurate hairline index
eliminates parallax errors, permits high readability.

fast measurement
full scale rotation in 4½ or 12 seconds for 60-cycle operation.

external key switches
can be located at the side of the indicator (as shown), below or above—wherever most convenient for the particular panel layout.

large number of points
additional key switch banks provide any desired number of temperature points. Legend plates facilitate identification.

high precision
calibrated accuracy is 0.2% of scale span.

variety of ranges
supplied for use with either thermocouples or resistance thermometers, in a selection of ranges applicable to power plant temperatures.

Squeezed for panel space?

THIS NEW

Honeywell temperature indicator

needs no elbow room!

CROWDED PANELS are no problem for this new temperature instrument . . . the Vertical Scale Precision Indicator. Its slender, compact case makes it a natural for graphic panels—and a readily-inserted, space-saving member of conventional generator and turbine boards.

Basically, it's the same *ElectroniK* Precision Indicator which the power industry and many others have used and relied upon for many years. But, its outside appearance has changed: it's a completely new design that places the bulk of the instrument mechanism *behind* the panel . . . uses the valuable front-of-panel space primarily for the indicating scale.

Equipped with key switch banks, the Vertical Scale Precision Indicator offers a fast, convenient way to spot-check temperatures in bearings, pumps, hydraulic couplings, motors and other potential hot spots.

Your local Honeywell engineering representative will be glad to discuss how this new instrument can save space on the new panels which you may be planning. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa.

● **REFERENCE DATA: Write for new Bulletin No. 1541 on the Vertical Scale Precision Indicator.**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Automatic Recorder

(*Continued from page* 168)

HAND MICROPHONE connected to recorder takes down record of switching over supervisory system controlling six substations

LOAD DISPATCHER records messages from ten circuits on automatic recorder during system disturbances. Information is recorded quickly and accurately. Play-back of recordings helps analyze disturbances and makes for better reporting by personnel

cuits, two private telephone keyboard buses, two telephone company circuits, the hand microphone, and two spare circuits.

Twelve circuits on the private-telephone key board are selected by keys which may be connected to the recorder by initiating the proper button on the recorder selector. Bell telephone circuits are equipped with four push buttons for selecting different lines.

The dispatching office includes a supervisory system for controlling 69-kv and 12-kv circuit breakers serving six substations in Phoenix. During severe storms, the hand microphone is used to dictate a record of switching while the operator stands at the control board.

A local firm provided the equipment, engineering, and installation according to specification for $1,837.80. Installed in June, 1953, use during the summer storm season proved that a recorder of this type gives an excellent record during disturbances.

"Back-Up" Truck Eliminates Accidents

A "back-up" truck carrying an illuminated "slow" sign has eliminated accidents to street lighting service men by automobiles crashing into parked trucks, and at the same time decreased one major source of multiple automobile accidents. This highway safety measure inaugurated over a year ago was developed by Broadway Maintenance Corp, Long Island City, N. Y.

The back-up truck is always parked 30 ft to the rear of the service truck used by electricians serving street lights from the top of ladders mounted on the truck.

The mobile safety sign is a 2x5-ft panel mounted on the top of the truck cab and fitted with 63 10-w lamps which flash and spell "Slow". Energy for the lamps is supplied by a generator driven by a power take-off on the truck.

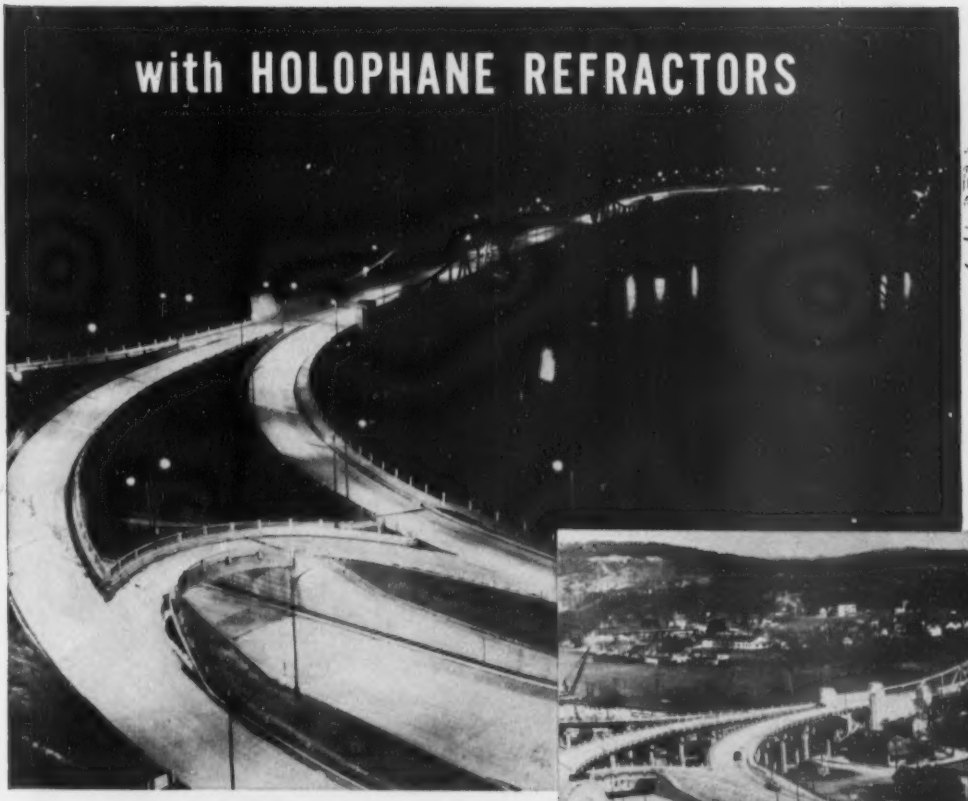
The truck also carries a revolving red turret light on top of the panel sign, and a pair of red flasher lights installed on both front and rear bumpers.

BACK-UP TRUCK with flashing "slow" sign placed 30-ft behind service truck is a back-up for highway safety during day or night when streetlight serviceman is at top of ladder

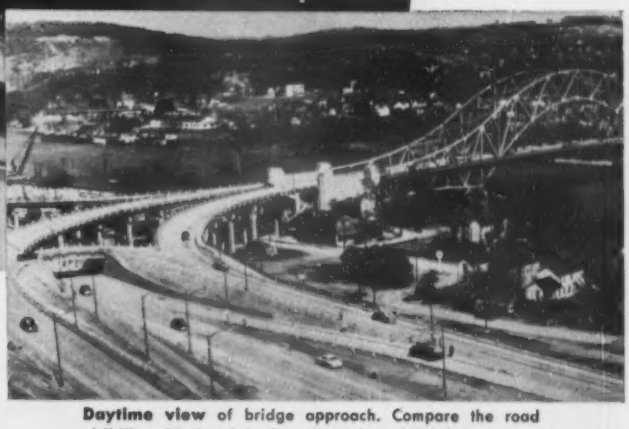
Prior to the development of the back-up truck, the accident rate to the company's street lighting maintenance electricians had ranged between one and four serious accidents per year. In all cases the accidents were severe because they occurred while the electricians were at the top of the ladders.

(*More How To on page* 176)

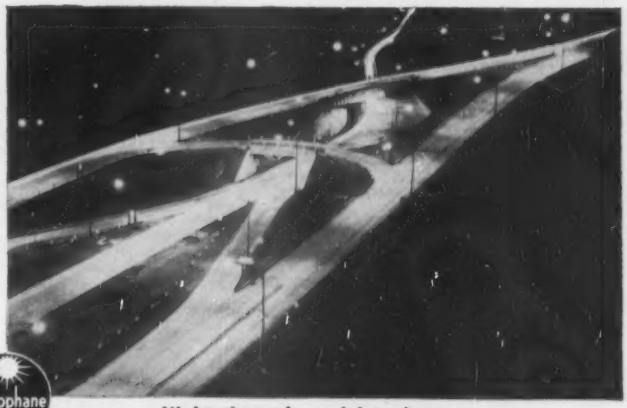
Daytime VISIBILITY *for Night-Time* SAFETY



The New Elizabeth Bridge between Elizabeth and West Elizabeth, Alleghany County, Pa.



Daytime view of bridge approach. Compare the road visibility with the night time view (above left) of same area.



Night time view of interchange roads leading up to bridge approach.

Another New Installation of Efficient HOLOPHANE REFRACTORS for MERCURY VAPOR LUMINAIRES . . . For Bridges, Interchange Areas, Super Highways

The increasing number of super-highways, with their stepped-up motoring speeds, has brought a demand for new and more efficient lighting systems to reduce night accidents. HOLOPHANE REFRACTORS meet that demand with utmost effectiveness. With their unique prismatic construction, they are specifically designed to utilize wasted light and put it only where it is most needed—over the roadway—to provide maximum visibility. They are economical to install and maintain, offer the greatest resistance to deterioration. Sound reasons why so many leading utilities use HOLOPHANE REFRACTORS to keep the new highways safe for after-dark traffic.

Write for latest book: "Street Lighting, A Guide to Good Practice," available without charge.

Photos: Courtesy of West Penn Power Company

HOLOPHANE COMPANY, INC.

Lighting Authorities Since 1898 · STREET LIGHTING DEPARTMENT, NEWARK, OHIO

THE HOLOPHANE COMPANY, LTD., THE QUEENSWAY, TORONTO 14, ONTARIO

let's lay it

on the line !

In almost every instance, aluminum conductor offers savings over copper. By one standard, the ASTM specs, aluminum conductors may look the same. By other standards, the electric light and power industry's own, Alcoa® Aluminum Conductor is a standout.

Here are the plus factors you get when you buy Alcoa Aluminum Conductor, and without paying a penny more!

1. Every run tested throughout every production phase for metallurgical, mechanical and electrical uniformity.

2. Consistently uniform manufacture and tight stranding.

3. Cable for every service requirement including designs for special applications.

4. The services of the largest and best qualified headquarters and field engineering staff in the industry.

5. The latest developments and newest applications backed by Alcoa's unequaled 55 years of experience and leadership.

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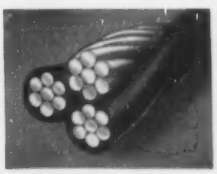
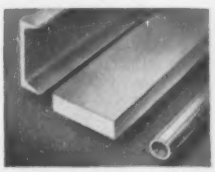
ACSR and All-aluminum Wire and Cable



Covered Wire and Service Drop



Bus Conductors of All Types

Accessories for All Conductors

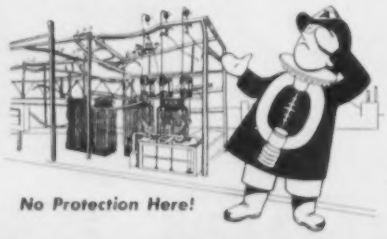
"Automatic" -FIRE-FOG

Much More Than a Little More Protection

With each new installation (photo shows water flow test on 50,000 KVA transformer*) "Automatic" FIRE-FOG establishes its ability to extinguish electrical fires faster, safer and more economically than any other method.

Heat sensitive rate-of-temperature-rise thermostats detect fire within seconds of its origin. Scientifically designed spray nozzles discharge mist-fine "Automatic" FIRE-FOG throughout the fire area. Extinguishment is complete — final. Significantly, "Automatic" FIRE-FOG protection is always in readiness for instant, automatic action; now — next week — next year, or whenever fire threatens.

More detailed information on "Automatic" FIRE-FOG as pertains to your particular needs is available upon request. Send the coupon.



No Protection Here!

* Installation for Hartford Electric Light Co., So. Meadow Sta., Hartford, Conn.

Stone & Webster Engineering Corp., Boston, Mass. — Engineers and Constructors.

"Automatic" Sprinkler Corp. of Amer.
Youngstown, Ohio

Please rush copy of Bulletin 64 — Design and Application of "Automatic" FIRE-FOG

Name .....

Title .....

Company .....

Address .....

City ..... State .....

"Automatic" Sprinkler
CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
Offices in principal cities of North and South America

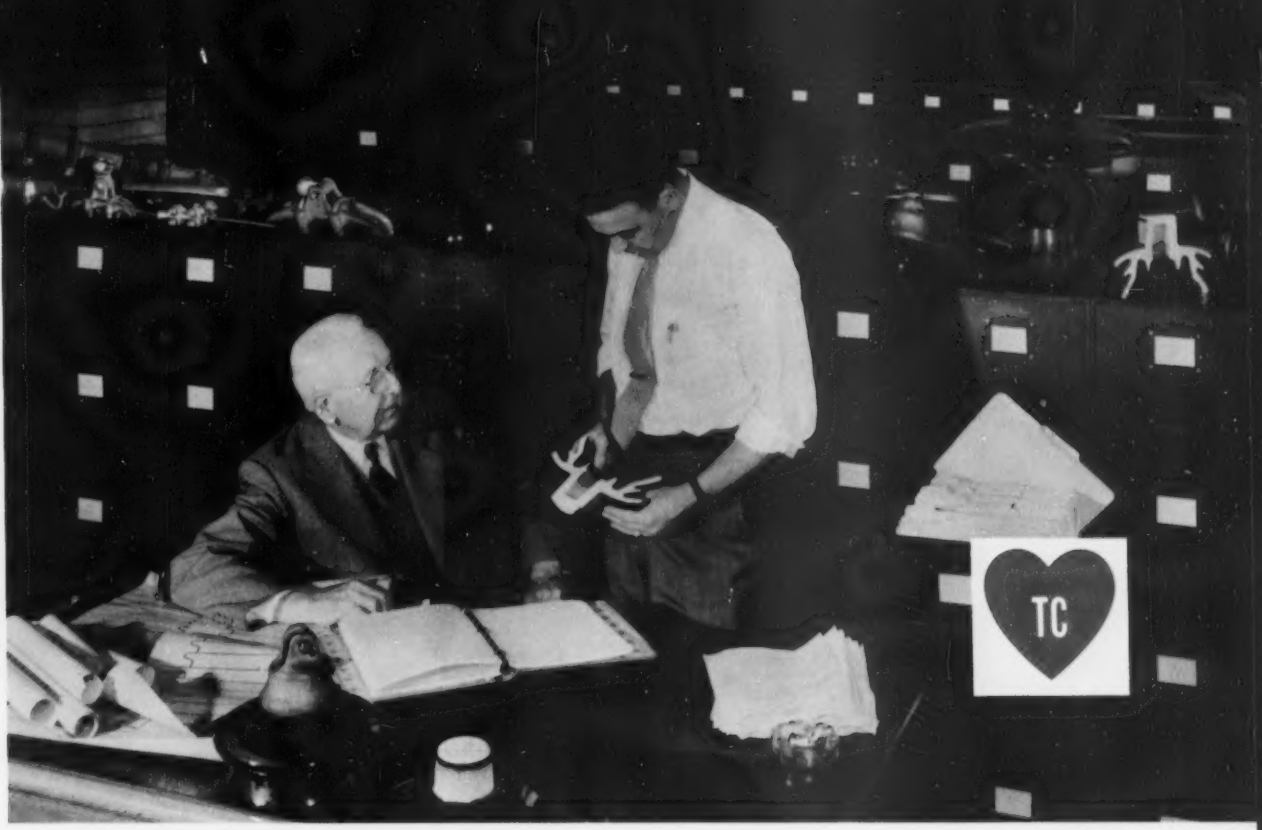
Bag of Wind Speeds Wire Pulling

Attaching a wire to a canvas bag and blowing the bag through a pipe with compressed air speeds pulling operations for British Columbia Electric Co. Percy Enefer, transmission and distribution worker, designed the bag. Its flexibility permits it to pass obstructions that would block solid projectiles.

Find Meter Parts Quickly

Finding thousands of meter parts in the stock of Oklahoma Gas & Electric Co's meter shop is simplified by a stock room meter parts catalogue.

(*Continued on page* 181)



Keeping Technical Competence Alive!

Perhaps you would like to study the basic test data leading to the original development of the present-day suspension insulator -- it's here, dated 1910-11! Or, you might like to see what it took to devise and perfect the treated sanded surface that imparted life and reliability to all insulator assemblies -- look under the dates of 1915-16. Briefly, we have within our files the recorded history of many major contributions leading to the development and refinement of the high-voltage porcelain insulator, as we know it today. These are the permanent records of the O-B Electrical Laboratory.

Extensive research facilities, capable men to use them, and results in terms of technical progress go right back to O-B's beginning. Everything that was ever done research-wise has been carefully preserved, right down to the tests run yesterday.

Think, for a moment, what all this means. Obviously, it proves the solid scientific background of today's O-B insulator and is evidence of more than a generation of Technical Competence. But the story is much bigger than this. The continuity of this record is matched by the continuity of technical personnel. Today, men of rich experience and background can hand down to the new generation of O-B engineers the priceless knowledge that "cold" reports cannot impart. This continuity of *both* records and men grows in value with each passing year.

Here, in the file room, we look backward. Out on the floor of the laboratory we look forward. But in either direction -- recorded history or tomorrow's projects -- O-B has never moved from its position of leadership in the insulator industry gained through its ability to conduct basic, major research on vital phases of insulation and its application.

This is one of the intangible things that have led to the faith men place in O-B insulators today. While materials and processes may be the machinery of a good insulator, Technical Competence is the heart of it!

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

the heart of every Ohio Brass insulator

Random selection of samples is made as pintype insulators come from the automatic forming machine.

Quick-setting, non-shrinking plaster is poured into the freshly formed pinholes.

We Give The Pinholes To The Inspector

Maybe you never considered the problem of holding proper tolerance in the threaded pinholes of pintype insulators. It presents some unexpected complications.

Threads are formed either by an eccentric "wobbler" tool or a reversing plunger. It's not an ordinary tapping process. This wouldn't work in soft clay. This tool requires adjustment, and the adjustment must be maintained. Furthermore, clay is very abrasive and wear on the tool is a big factor. How do you control the accuracy of such an operation?

It takes a week or more for the freshly-formed, soft, moist clay to reach the chalky-hard, air-dry state. In its original putty-like consistency, accurate gauging would at least be slow and costly -- perhaps impossible. Wait a week for hardening, then find out you're off, and you've lost a week's production. Let imperfect pieces go through the kiln and you have doubled your cost; correspondingly your loss. Let these imperfect pieces get into the field and they won't fit the pin. You've got to make quick, accurate inspection of the pliable clay right as it comes off the forming machine -- but how?

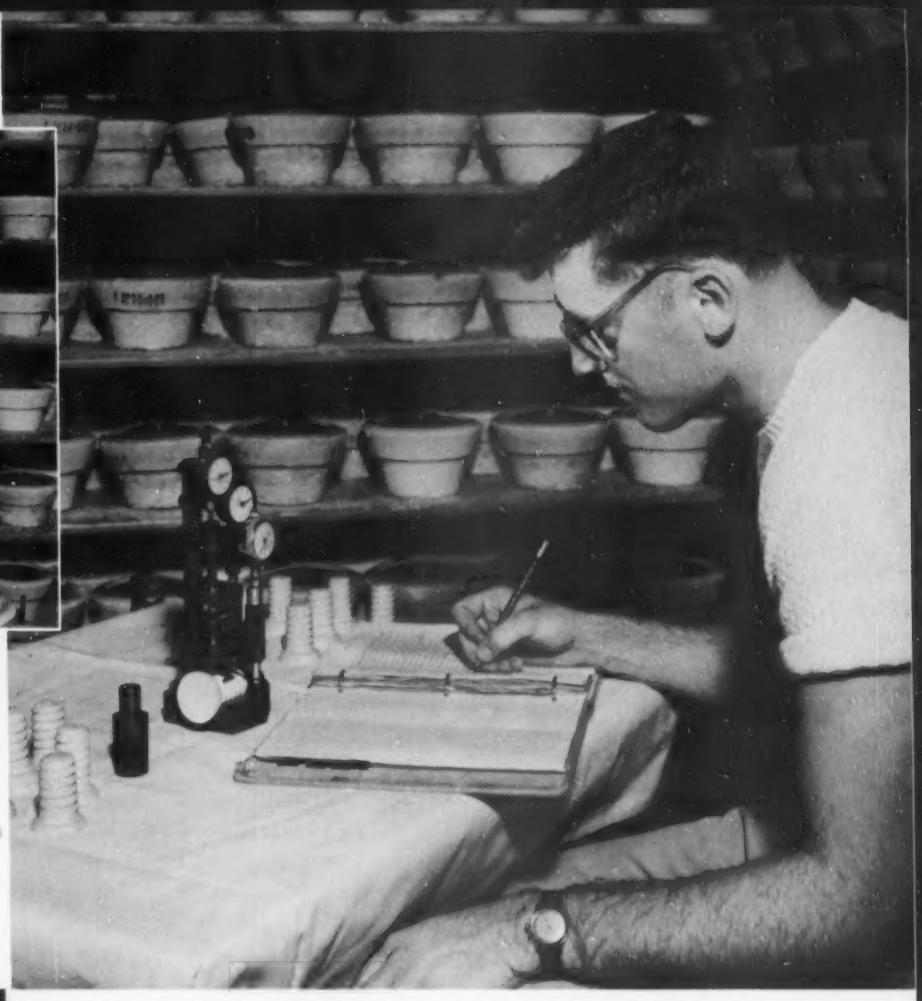
You may call this just ingenuity. We believe it's a good example of O-B's Technical Competence -- putting brains to work to assure a first class product. Here's the practical answer: Random sampling is made of freshly-produced insulators. A man with a small bucket of special fast-setting, non-shrinking plaster fills the pinholes of his selected specimens. He then strips off the soft clay and has an accurate cast of the pinhole cavity which is tested by a precision dial-type "go and no-go" gauge. This method practically eliminates rejections for pinhole variations at final inspection. And, best of all, your O-B pintype insulators really fit your pins, because pinhole gauging has been made a precision operation.

Some of the best engineering consists of keeping things simple and, if this be true, here is a well-engineered process. It puts the touch of quality into an every-day product, and does this inexpensively. In fact, Technical Competence is always adding un-seen and un-charged-for things that end up in giving you more for your money when you specify O-B.

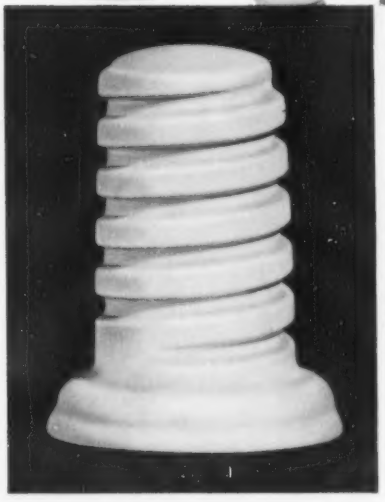
OHIO BRASS COMPANY, MANSFIELD, OHIO

In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

The soft clay is stripped away, and all that remains is an accurate cast of the pinhole cavity.

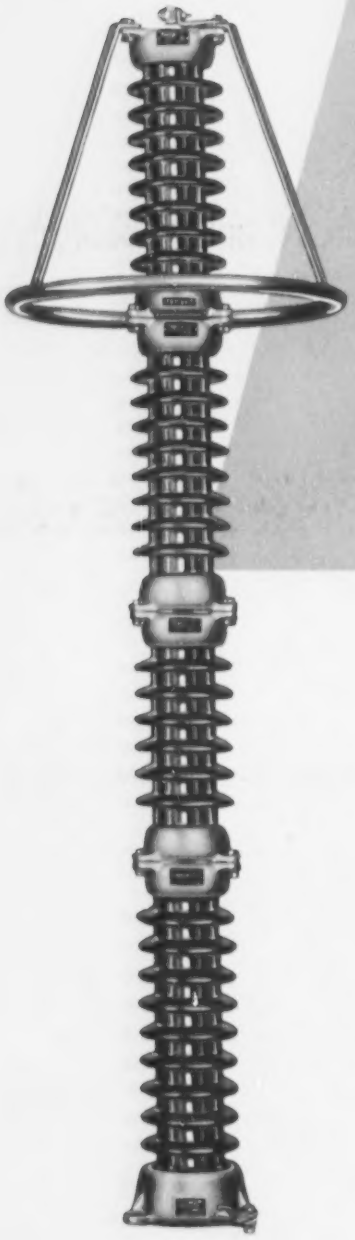


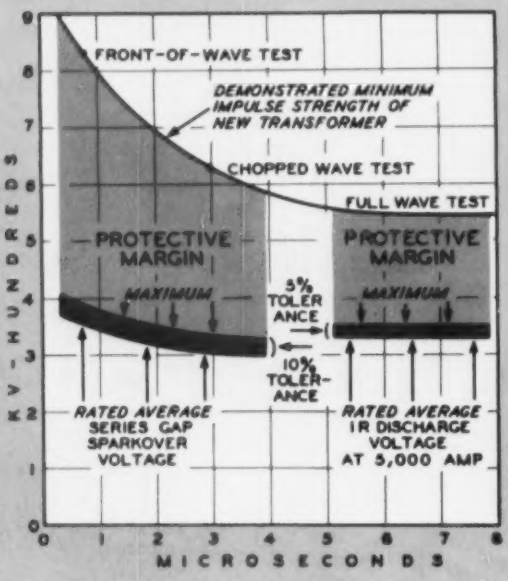
Precision dial gauges measure the cast for size, taper, and depth of thread in accordance with a comparative standard.



TECHNICAL COMPETENCE the heart of every *Ohio Brass* insulator

"MAXIMUM PROTECTIVE LEVEL" . . . a lightning arrester rating that counts because you can count on it!





Protective Margin, as illustrated in this typical application curve, is that zone existing between MAXIMUM arrester protective rating (tolerance added to average rating) and minimum insulation strength of equipment.

Basically, a lightning arrester is a PROTECTIVE device -- you invest your dollars in protection and have a right to know what you are buying!

How is protection measured? Average values don't express it, unless you are sure of getting an *average* arrester -- which you aren't. Departures from average, occurring in any mass-produced product, are defined by tolerance. Realistically you can *be sure* of only one thing: full tolerance added to rated average, representing the rare but still possible poorest specimen that will pass inspection. This rating of average plus tolerance is expressed by "Maximum Protective Level" -- *the one thing you can count on!*

The attached simple curve shows where Maximums fit into the protective performance of a typical lightning arrester. Remember, the zone of Protective Margin is what you're buying, and see why it is measured from Maximum value, not from average.

-- and when you sift down the economic factors relating to all lightning arresters, you will find that the O-B Thorex gives you the most protection for your dollar!

Ohio Brass

MANSFIELD OHIO • U. S. A.

IN CANADA—CANADIAN OHIO BRASS CO., LTD. • NIAGARA FALLS • ONT.

4411-H

Meter Parts

(*Continued from page* 176)

Every part in stock is listed in the catalogue which shows the stock bin in which the part is kept. When the location of a part is changed its listing in the catalogue is changed, keeping listing up to date.

Parts for many types of meters made by four different manufacturers are kept in the shop stock. Finding the right part at the right time was not always easy until the catalogue idea was developed.

TREE TRIMMING and tough line construction jobs are made easy by this industrial monkey that has controls in the crow's-nest.

Crow's-Nest Makes Tough Jobs Easy

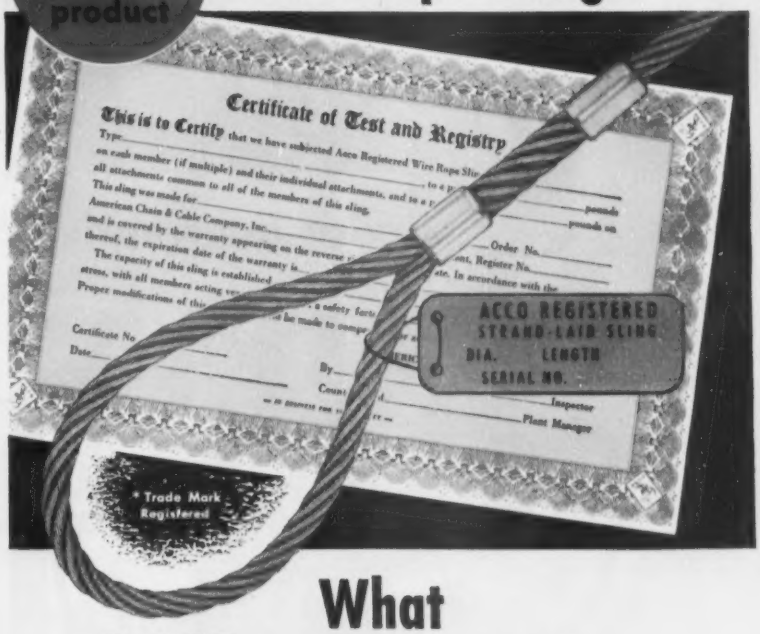
Tough line construction and tree trimming jobs on the Dallas Power & Light Co system have been made easier with an "industrial monkey." Hydraulic controls at the "crow's-nest" permits the nest to be positioned at any spot up to 33 ft above ground in a 270-deg arc. Thus, the operator can place himself in the most advantageous position for the work being performed.

Crow's-nest is insulated by 33-kv pillar insulators which allows the operator to be at line potential. This dispenses with rubber protective equipment and allows the man to wear only leather gloves.

To date the industrial monkey has been used for the more difficult tree trimming jobs, for installation of breakers in a 13-kv line preparatory to the installation of an air-break switch, for handling of long strings of

an ACCO product

ACCO Registered* Wire Rope Slings


Certificate of Test and Registry
This is to Certify that we have subjected Acco Registered Wire Rope Sling
ACCO REGISTERED
STRAND-LAID SLING
DIA. LENGTH
SERIAL NO.
* Trade Mark Registered

What ACCO Registered Means

• Primarily it means greater safety for your men and machines when loads are carried in the air in your shop. It means insurance against dropping a load which could tie up production.

But that's only part of the story. The name ACCO *Registered* on the slings you use means greater efficiency because of better design of endings and attachments. It means lower overall sling costs because every part of every ACCO *Registered* Wire Rope Sling has the same strength as the catalog breaking strength of the rope itself. ACCO even magnafluxes each hook to make doubly sure it will serve you well.

And it means that the sling has been proof-tested at the factory to twice its rated capacity. You can be sure that every ACCO *Registered* Wire Rope Sling is the safest, strongest and lowest cost lifting tool you have ever used.

Best of all, you can get them when you need them from a nearby stock. Contact your ACCO *Registered* distributor today for full information and prices. Or, write our Wilkes-Barre, Pa., office.

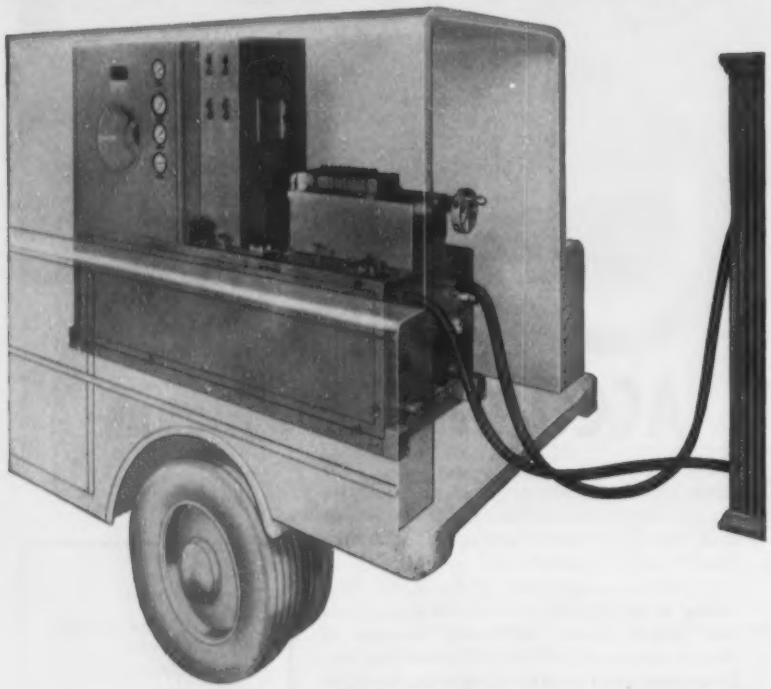
1 The best material
2 Unit safety factor (on bodies, rings, links, safety shackles, hooks)
3 Proof test of complete sling to twice rated capacity
4 Actual field service test of each model
5 Metal identification tag on each sling
6 Signed Registry Certificate with each sling

ACCO TRADE MARK

Wire Rope Sling Department
AMERICAN CHAIN & CABLE

Wilkes-Barre, Pa., Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn. • In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

plus Links Shackles Hooks



● With BOWSER Hydro-Volifier

In a single pass the Bowser Hydro-Volifier restores oil dielectric to 35 k.v.!

This fully automatic process effectively removes volatile, corrosive acids, gases, dissolved moisture and solids while the equipment remains energized . . . *no service interruption!*

May we send you complete data?

BOWSER

BOWSER, INC.
1384 Creighton Avenue, Fort Wayne 2, Indiana
Regional Offices • Atlanta • Cleveland • Dallas • Fort Wayne
Kansas City • New York • San Francisco • Washington, D. C.
Canadian Plant and Sales, Hamilton, Ontario

disc insulators at 60-kv substations, and for servicing of potheads on cable terminal poles.

The unit is equipped with an air compressor and air-operated pruning tools.

Spare Parts Policy Provides Savings

A spare parts policy adopted by Detroit Edison Co is expected to save money by eliminating nonessential spare parts. Value of spare parts and special maintenance items and the cost of maintaining them represents an appreciable investment to the company.

A spare part is defined as an item which must be stocked to take care of an emergency arising from a possible failure.

A maintenance item is defined as having a rate of wear-out or depreciation that can be approximated and must be stocked in anticipation of predicted need.

Every effort is made to reduce spare parts to a practical minimum consistent with proper operation. As a policy and guide for department heads and others, the following points have been formulated:

1. No spare parts should be stocked to protect the company against double contingencies.

2. No spare parts should be kept when parts are readily available.

3. Where plant, station, or system has adequate reserve capacity, spare parts should not be stocked when probability of a second failure is remote before original failure can be repaired.

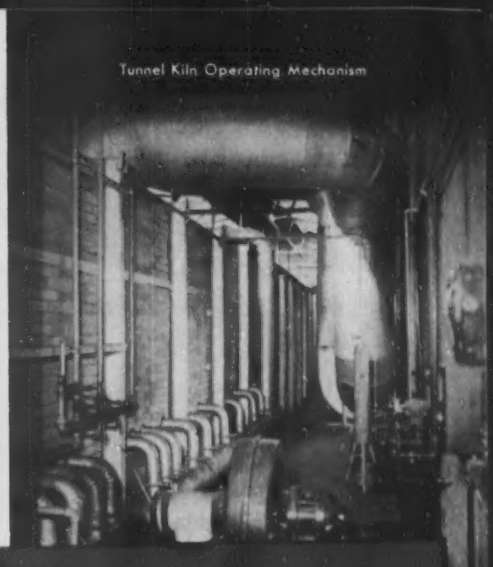
4. Whenever two or more plants or stations require identical parts, parts should be pooled and the quantity carefully analyzed.

5. Spare parts shall be initially stocked only with approval of the manager of operations.

6. Each department shall review their minimum requirements at least once every 2 years. This may be done when re-ordering, when equipment is declared obsolete, or by a periodic review.

7. Sources of supply should not be unduly limited. Wherever possible, items should be established so that parts can be obtained from several vendors.

Victor Tunnel Kiln No. 2—
(end and side view)



Tunnel Kiln Operating Mechanism

Another Reason Why—

VICTOR Makes Better Insulators

WE USE RECIRCULATING TUNNEL KILNS EXCLUSIVELY!

The firing process can literally make or break an insulator. By leaving nothing to chance, Victor "know-how" gives you the most perfectly fired high and low voltage insulators that money can buy.

Employing tunnel kilns exclusively, Victor research has done much to advance firing techniques. The use of re-circulation of heat to attain accurate, even temperature control, the use of optical pyrometers to measure tunnel kiln temperatures, automatic control instruments and silicon carbide kiln furniture are examples.

No wonder Victor *Purified* Porcelain Insulators are harder, denser, have more impact resistance, last longer and ultimately cost less! For the full story, send for our free booklet, "The Story of Victor and Purified Porcelain." Tells how research made possible this great insulator advance.

VICTOR NO. 245-R
(EEI-NEMA Class 56-3)
TRANSMISSION PINTYPE

Specify

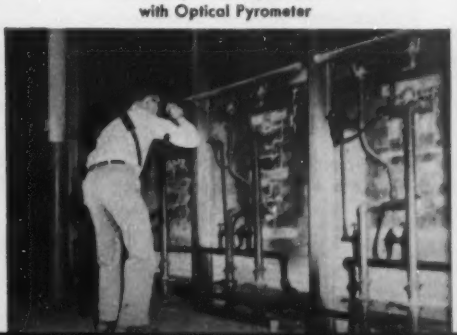
VICTOR PURIFIED PORCELAIN INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators
• Custom Designed Porcelain • Insulator Hardware

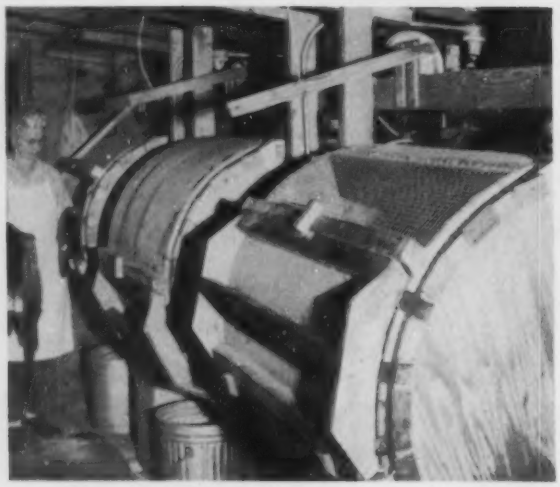
Loaded Car Entering Tunnel Kiln

Checking Kiln Temperatures
with Optical Pyrometer



Tunnel Kiln Control Panel

PELT DRYING ROOM maintains temperature at 65 F and positive pressure at 0.25 in. Drying time has been cut from 48 to 36 hours



DRY CLEANING of newly fleshed pelts is done in slowly rotating motor-driven drums. Ground white corn cobs are the cleaning agent

Electric Heat Speeds Pelt Drying

ARTHUR KRAMER, Advertising Director Puget Sound Power & Light Co Seattle, Washington

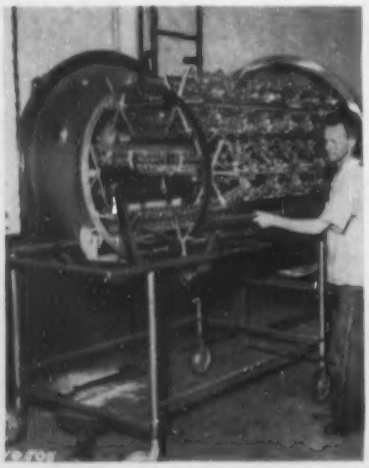
Drying time for fur pelts has been reduced 25% in a temperature and pressure-controlled drying room designed by Puget Sound Power & Light Co for Creque's Pelting Service, Puyallup, Wash.

This company prepares mink, fox and chinchilla pelts for sale as raw fur. It is the receiving agent for four large fur auction companies and serves fur farmers in the 11 western states. During the last pelting season, Creque's handled more than 35,000 mink pelts valued at over $750,000.

The drying room was engineered by Puget Power's experimental laboratory to hold air temperature at 65 F and positive pressure at 0.25 in. above outside pressure. In addition, the air is completely changed every 2 min. These conditions eliminate "dead" air spots in the room and permit the close spacing of pelts on wall slots from floor to ceiling. Pelts are dried in 36 hr, compared with 48 hr under the former method.

Air is blown into the room through baffled ceiling units each equipped with a 5-kw electric heater. Air is vented to the outside through openings at floor level. Operation of the blowers maintains the pressure while a wall thermostat controls the temperature.

Before pelts are dried they are dry cleaned in slowly rotating motor-driven drums. The gently dropping and tumbling action amid a mixture of ground white corn cobs thoroughly cleans the pelts so that they are ready for further processing.



METALIZING UNIT deposits metal finish on plastic toys by a vacuum process

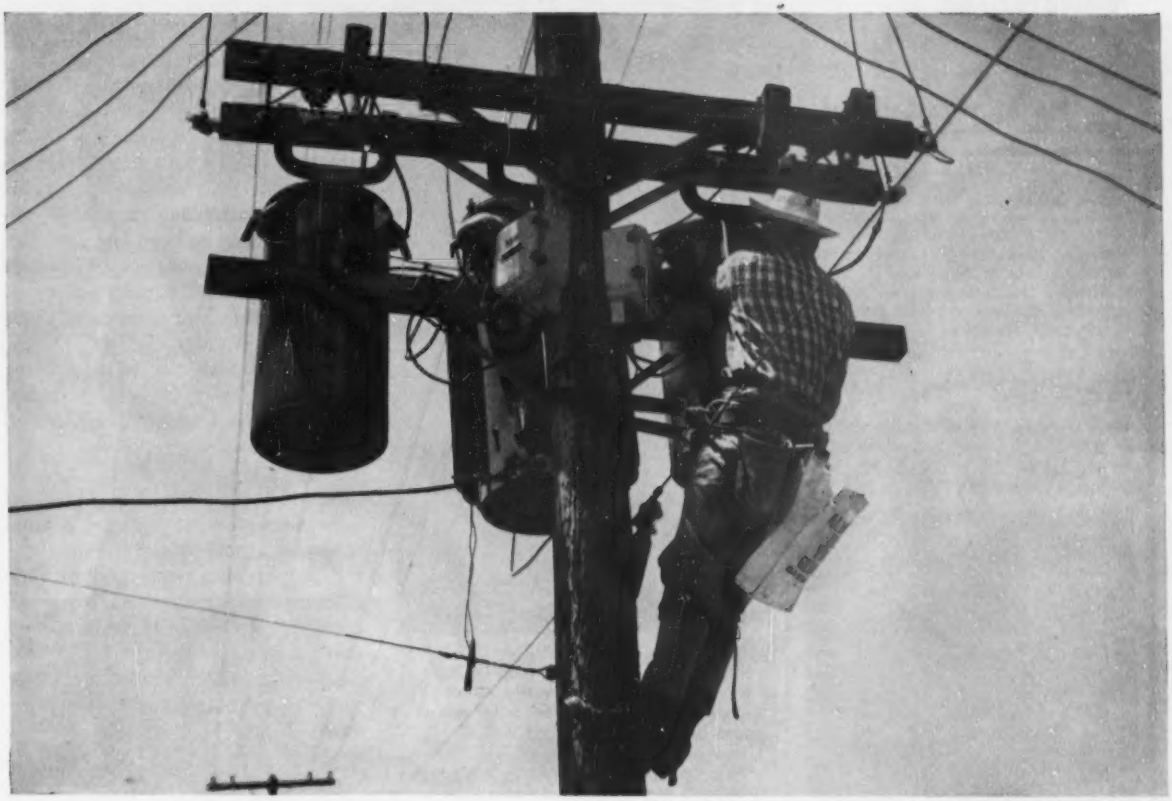
Vacuum Metalizing Improves Plastic Toys

L. ALBERTSON Market Studies and Service Division, Philadelphia Electric Co Philadelphia, Pa.

Metal coatings are applied to plastic toys at the Harmonic Reed Co, Rosemont, Pa. by a "vacuum metalizing" process. The result is an attractive, brilliant and uniform finish serving a functional as well as a decorative purpose. The process has lowered the unit cost.

Toys prepared for metalizing are first given a base coat of lacquer, baked by convection heating in an electric oven, then attached to racks and enclosed in a chamber where a high vacuum is drawn. High temperatures exceeding the melting point are applied to the metal to be deposited, and followed by a 5 to 10-sec flash. The metal vaporizes and the vaporized molecules characteristically travel from the source in straight lines to deposit themselves on the first facing surface. The metalizing unit is operated by a 15-kva generator.

DISTRIBUTION ENGINEERS



This installation on a transformer bank uses two Lincoln Graphic Meters.

Take the guesswork out of your system operation

"Should we apply corrective measures now, or wait until trouble develops on this circuit?"

You can't afford to use guesswork methods to answer questions like this. Under today's rate of load growth you have the doubly difficult job of giving better service while loading closer to capacity with only a small safety factor.

You need accurate knowledge of load conditions to render good service and still get the best return on your system investment. Such knowledge can be obtained only through *measurement*.

Sangamo's booklet "Solving Distribution System Problems Through Measurement" tells how a number of utilities are solving this problem with permanent installations of Sangamo Thermal Meters. It tells about periodic surveys, too. Just clip the coupon below for *your* copy.

Only Measured Facts are Known Facts

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SM54-1

SANGAMO ELECTRIC COMPANY, SPRINGFIELD, ILLINOIS

Send my copy of "Solving Distribution System Problems Through Measurement"

YOUR NAME_____

TITLE_____

COMPANY_____

CITY and ZONE_____ STATE_____

what's NEW in Engineering

A new, fast coupling for simplifying connections of tubing or piping, regardless of the size or purpose, is said to need no threading, flares, ferrules or tools to make the connection. A spring clip is pressed, the tubing is inserted, the spring is released and the connection has been made in one quick operation.

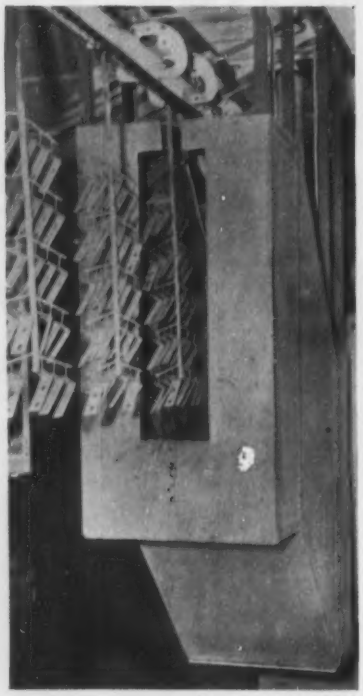
Sticky to dry bauxite in 13 miles and how to handle it effectively at both ends was just one problem facing Kaiser Engineers in developing mining facilities in

Jamaica. Self-heating truck bodies and other specially designed handling methods licked this problem. At the same time, the versatile talents of Kaiser Engineers were focused on all other facilities at the island mine: housing, drying, storage, a 995-foot dock, 13 miles of railroad and a 1,000 ton-per-hour conveyor loading system being just a few of them.

Chemical Business Handbook, just published, is the title of a valuable new book edited by John H. Perry. It is a reference book of modern business management keyed especially to the needs of the chemical and chemical engineering industries.

When it comes to research, preliminary engineering studies, engineering design and layout, estimating, preparation of specifications, construction programming, negotiation of contracts, and procurement and expediting of materials and equipment – call or write: Kaiser Engineers Division of Henry J. Kaiser Company, Kaiser Building, Oakland 12, California.

Infrared Speeds Metal Parts Drying



Edwin L. Wiegand Co

DRYING METAL PARTS in infrared oven after washing and bonderizing saves floor space. Conveyor speed of 6 ft per min dries 3000 lb per hr

An infrared electric heating installation has speeded drying of metal parts for Unistrut Corp, Wayne, Michigan. Twelve 1,800-w electric radiant heaters focus heat on parts as they leave washing and bonderizing tunnels.

Compactness of oven saves valuable floor space. All-metal construction and long life of heating elements minimize maintenance problems. Initial and operating costs are low. Infrared energy produced by radiant heaters is absorbed equally well by all colors, making heat adjustment easier and more accurate.

With a conveyor speed of 6 ft per min, 3,000 lb of brackets, angles, channels, clamps and similar parts are dried per hour.

The all-metal radiant heaters, mounted at an oblique angle, assure even absorption of heat by passing work. Accurate heat regulation for varying part sizes is provided by variable input controllers and magnetic contactors. Controller settings can also be varied to compensate for changes in rinse temperature, ambient building temperature and humidity.

Infrared Aids Oil Drum Reconditioning

FORD BATES, Power Sales Engineer, Omaha Public Power District, Omaha, Neb.

A 142-kw infrared oven is used by Socony-Vacuum Oil Co, Omaha, Neb. for baking enamel on reconditioned oil drums. The oven makes it possible to turn out reconditioned, freshly-painted drums in assembly-line fashion. Extra handling is eliminated, inventory of drums is reduced, a better-appearing package is sent out and the life of the drums is increased by the superior wearing quality of the baked-enamel finish.

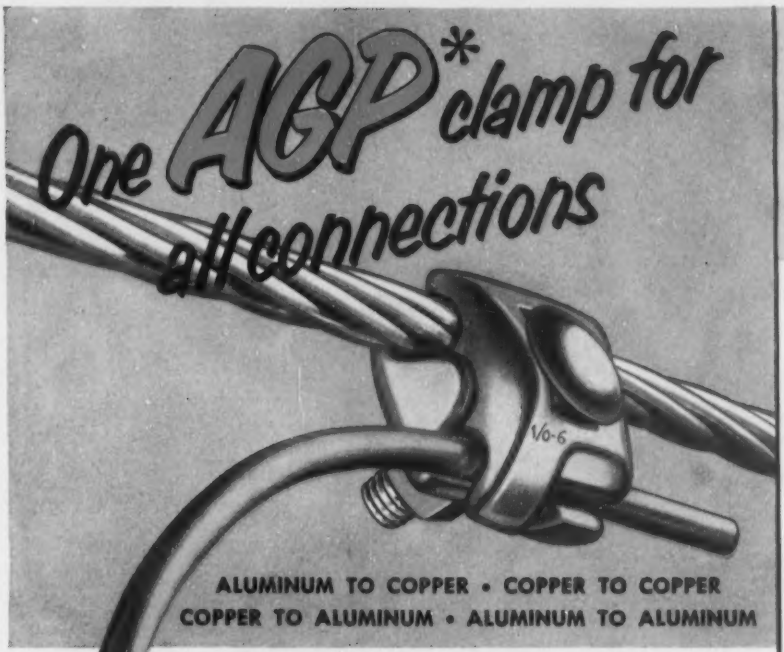
With the former air-drying method, it was necessary to stack drums to dry after painting. This required double handling before filling and shipping. Now drums are spray painted, electric baked, filled and shipped in a continuous operation.

The new electric method has contributed greatly to reversing the cost of the operation which had been going higher each year.

Baking enamel on reconditioned oil drums in infrared oven increases life. Assembly line eliminates handling and inventory is reduced

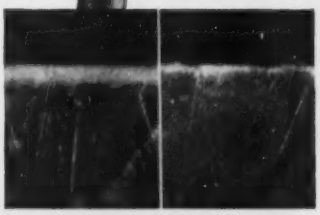
(*Industrial Briefs on page* 190)

One AGP* clamp for all connections

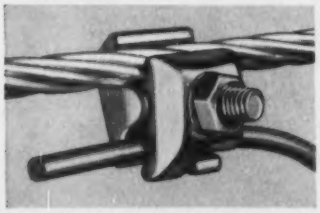


ALUMINUM TO COPPER • COPPER TO COPPER
COPPER TO ALUMINUM • ALUMINUM TO ALUMINUM

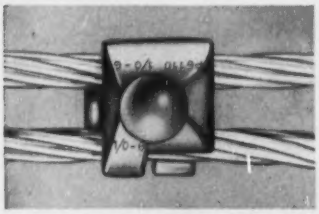
Protect your conductor with THE CLAMP THAT'S AHEAD OF THE TREND



Micro-photograph shows how high-density fortified cadmium, applied to a thickness of .001" on Chance AGP Clamps, compares with commercial plating at right.



Overlapping contacts on one side and a straight slide-in groove on the other help the attachment of the tap to the line.



Top view of clamp shows extra wide gripping jaws that contact all outside conductor strands in the entire size range.

Connecting copper and aluminum conductor requires a general purpose connector as good as the conductor itself in conductivity, mechanical stability and corrosion resistance, if future trouble on the line is to be avoided.

The best connector for this purpose is an aluminum bodied clamp with a *properly applied coating* of high density, fortified cadmium, proved best by every test for long-lasting, troublefree, general purpose connections.

That's what you get in the New Chance AGP Parallel Groove Clamp, companion to the widely tested and accepted Chance AGP Tap Clamp. The Chance PG110, shown above, can be used for any combination of aluminum or copper in a size range 1/0 ACSR to No. 6 copper *both sides*. This clamp is heavy in construction—yet light in weight. The high tensile strength bolt swivels into position without binding or bending. The wide jaws of this clamp contact every strand of any conductor in the entire size range. Rounded edges protect the conductor against damage from vibration.

Chance PG110 is your universal clamp for most applications. Larger sizes with the same features are also available. Write for complete information.

*Aluminum General Purpose

FORTIFIED CADMIUM ...proved best by test for joining aluminum and copper conductors

Read these Statements!

They're from leading manufacturers of aluminum conductor, power companies, and research laboratories. (Names on request).

"Where outdoor weather resistance is required, *cadmium is the best metal to deposit on aluminum.*"—Laboratory.

"This is the most logical solution to the problem of making aluminum to copper connections."—Conductor Manufacturer

"All factors considered—corrosion, electrical requirements, service—cadmium plated aluminum connectors, plated according to the method used by the Chance Company, are the best possible combination for use on aluminum conductor, for aluminum or copper taps."—Conductor Manufacturer

"Your AGP connector, cadmium clad as you do it, is going to solve one of our greatest problems of making lasting A and C connections."—Power Company

"The value of cadmium plated coatings has been completely demonstrated. Their high resistance to atmosphere, corrosion, to salt spray and to alkali has made them outstanding as a corrosion-resistant coating."—Laboratory.

"I prefer cadmium because of its outstanding resistance to corrosion in contact with aluminum and because of its inherent low contact resistance."—Conductor Manufacturer

"Our research laboratory found an average cadmium coated thickness of .002" on your AGP clamps. This is considerably more than the .0005" coating implied by ASTM specification A-165 Type N.B."—Aluminum Manufacturer

"Your AGP clamps were subjected to approximately 500 hours in a humid sulphide atmosphere and after cleaning to remove the sulphide coating which had formed on the exterior they showed no evidence of a breakdown of the fortified cadmium plating."—Eastern Utility

ABC INDUSTRIES

A·B·CHANCE CO·
CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

CCSA-11

G.I.
FIELD

What other capacitor in the field has stood up so well under the transient over-voltage conditions created by lightning? Or, can point to such a record of continuous trouble-free service year after year? Over 4,000 time-tested Cornell-Dubilier capacitor installations have proved that these are, without question, the most consistently dependable power-factor capacitors.

TEST

Behind this unsurpassed field performance record is C-D's superior design that builds into every C-D capacitor that extra margin of safety. These built-in extras mean lower volts per mil unit stress, lowest volt-ampere per square inch of radiating surface and the highest major insulation level.

As the final safeguard to assure you of maximum value for your capacitor dollar, only C-D pre-delivery quality tests every capacitor at its full rated voltage. We'll be glad to point out initial investment savings and year after year operating economy possible with a C-D capacitor installation. Cornell-Dubilier Electric Corporation, Dept. D-54, South Plainfield, New Jersey.

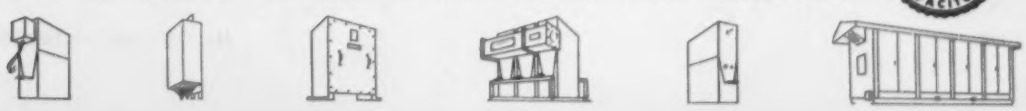
ONSISTENTLY EPENDABLE

CORNELL-DUBILIER CAPACITORS

FOR POWER-FACTOR IMPROVEMENT

PLANTS IN SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY: THE RADIART CORPORATION, CLEVELAND, O.

THERE ARE MORE C-D CAPACITORS IN USE TODAY THAN ANY OTHER MAKE



SARA*

THE AUTOMATIC BRAIN THAT PROVIDES CENTRALIZED PLANT CONTROL

GENERATOR NO. 5 STATOR TEMPERATURE HIGH '53 JAN17 84 15 25
GENERATOR NO. 7 NEUTRAL RESISTOR OVERVOLT RELAY OPER '53 JAN17 94 10 20
CONTROL BLDG. 440 VOLTS BUS VOLTAGE FAILURE '53 JAN17 11A 7 06
GENERATOR NO. 5 STATOR TEMPERATURE NORMAL '53 JAN17 2P 12 40

observes, annunciates and records in writing every variation in equipment operation

SARA, the Sequential Automatic Recorder and Annunciator, literally sees all —tells all! This new Taller & Cooper control equipment keeps a constant watchful eye on as many as 500 separate plant operations—instantly announcing and automatically recording sequentially any change of conditions, even when they occur within milliseconds. Yet, this amazing system costs only slightly more than an ordinary annunciator.

Write today on company letterhead for New Technical Bulletin No. 206 on SARA.

TALLER & COOPER, INC.

ENGINEERS • MANUFACTURERS
93 FRONT ST. • BROOKLYN 1, N. Y.

TOLL COLLECTION SYSTEMS • TOLL BOOTHS • POWER CONTROL EQUIPMENT
DIGITAL COMPUTERS • WIND TUNNEL INSTRUMENTATION • SPECIAL PURPOSE INSTRUMENTATION

INDUSTRIAL BRIEFS

Electric comfort heating installation at new 600-sq ft office of Active Fire Escape Co, Cincinnati, O., cost less than half that of a fuel-fired system. Both company and employees are pleased with the draftless, clean, low maintenance heating. The five 1000-w glass panel heaters are controlled by three thermostats. A 600-w unit with individual thermostat is used in each of the adjacent lavoratories. T. V. Morrow, Power Engineer, Cincinnati Gas & Electric Co.

Electric water pumping at Cambridge, Mass. Water Department's Fresh Pond pumping station has replaced old steam pumps and assures plant capacity of 36 mgd per day. New installation has three 2,300-v, 500-hp motor-driven pumps—one operating on base load, a second for automatic regulation of pressure, and a third, as a reserve. Two 13.8-kv feeders insure high service continuity. Cambridge Electric Light Co.

Heat treating gears and certain wear-resisting parts of various accessories and devices in electric salt bath furnaces at Jack & Heintz plants, Cleveland, Ohio, has speeded operations, cut rejects to practically zero and eliminated distortion, decarbonizing, scaling and grinding. Over 1440 lb of gears can be turned out per 8-hr shift. Over 4800 countershaft gears can be case hardened in two 8-hr shifts. Only one operation is needed to operate entire line. Equipment includes two 50-kw liquid carburizing furnaces; two 50-kw neutral baths and one 60-kw furnace (for martempering). Ajax Electric Co, Tips and Trends

Industrial air conditioning at Muirson Label Co, Inc, So. Meriden, Ct., stabilizes production rates in turning out several million labels daily for canned and bottled goods. Year-through relative humidity of 50% and 76 F constant temperature are maintained. Stretch of sheets, wave and curling of stored paper are controlled, set-up times reduced. Printing troubles are lessened. Two 50-hp motor-driven automatically-controlled compressors provide cooling for the system, while 22.5 hp in blowers deliver air to press and engraving rooms. . . . Connecticut Light & Power Co.

years of safe, sure, efficient lubrication ahead for these turbines with GULFCREST OIL

Modern equipment in a modern plant—line up of six large General Electric steam turbines in the O. H. Hutchings Station of the Dayton Power & Light Company generating plant which is located south of Dayton, Ohio, on the Miami River. Gulfcrest Oil provides the vital lubrication for all six units.

Gulfcrest's unmatched record of outstanding performance in every type of steam turbo-generator guarantees safe, sure, efficient protection for these six units down through the years.

A record like this did not just happen. It is the result of careful selection of crude oils that are thoroughly refined, then super-refined by Gulf's exclusive Alchlor Process—plus the right combination of the right chemical additives, and rigid quality control.

Gulfcrest's performance record includes installations where the original fill has been in service more than 15 years.

The next time you fill a turbine system, make it a fill for safe, sure, long-lasting protection. Specify the world's finest turbine oil—Gulfcrest. Call your nearest Gulf office today and have a Gulf Sales Engineer recommend the proper grade.

Gulf Oil Corporation · Gulf Refining Company
1822 Gulf Building Pittsburgh 30, Pennsylvania

GULF INDUSTRIAL LUBRICATION

ILLUMINATED PANELS identify self-service depositories in appliance stores. Payment envelopes are dropped into locked containers

METAL SIGN marks location of the depository. Seven units will serve growing urban areas at present. Others will be added as needed

Self-Service Pay Stations Serve New Areas

FRANKLIN W. ROBERTS
Commercial Director, Dept. of Water & Power, Los Angeles, Calif.

Low-cost, self-service depositories are making it easier for Los Angeles Department of Water and Power customers who shop in new commercial centers to pay their electric and water bills. After three years' experience with a test model, the Department is installing six additional depositories to serve newly developed areas that are too distant from established district and branch offices of the Department.

Use of depositories is considered an improvement over the practice of authorizing a retail merchant to act as collections' agent. Unlike that plan, wherein the merchant has to spend considerable time in accepting payments, the depository requires a minimum of time for servicing. The storekeeper's responsibility will be merely to maintain payment envelopes in adequate supply and to make change when requested.

The depository consists of a wood cabinet, measuring about 19x24x40 in., and two self-locking metal payment containers. The top of the cabinet, which is 22x30 in., provides writing space, a holder for payment envelopes, and has a ball-point pen attached by a flexible chain. Under a flashing "At Your Service" sign is a plate giving complete instructions on how to use the depository. The cabinet has illuminated panels on three sides that serve to identify the depository and also carry advertising messages.

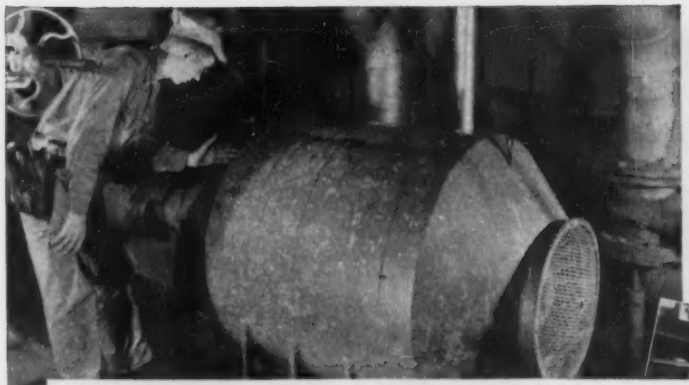
A payment-deposit slot in the top of the cabinet connects by a chute to a steel payment container in the interior of the cabinet. Each container will hold about 300 payments. Special precautions are taken to safeguard customers' cash and checks in the payment container. First of all, the container has a padlock for securing its top and a special locking slot in the top. The container is placed in the cabinet with the padlock on and the slot unlocked.

A handle has to be turned to open the payment container slot lid. The container then cannot be withdrawn until the handle is turned and the slot lid closed, at which time it locks shut. The container then cannot be opened, except by force, until it is returned to the main office. There the padlock is removed, the payments accounted for, and the lid-locking mechanism reset.

The container is inserted into the cabinet through a door in the cabinet which is also locked. As a final precaution, a photocell counter records the number of envelopes that drop into the container. This record is noted by the Department representative who picks up the containers daily and takes them to the nearest branch office or the main office. Daily pickup of payments insures prompt credit to customers' accounts.

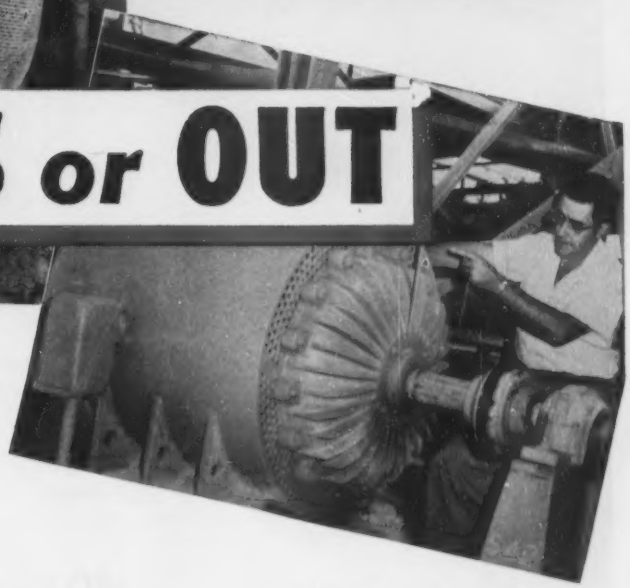
During the three-year test period for the first depository, no claims of loss have been received, and 20-25% of the 2,500 customers in the surrounding area use the service regularly. The nearest branch office is five miles distant. Notice of the installation of the unit was made by announcements enclosed with bills to all customers within a 2-3 mile radius of the location.

(*Continued on page* 196)



ALLIS-CHALMERS
Totally-Enclosed
Fan-Cooled
MOTORS

INDOORS or OUT



DIRT and CORROSION

Can't Hurt These Motors

Here is a totally-enclosed type of motor that will solve many of your dirt and corrosion problems. Install anywhere, indoors or out.

Cooling System is Self-cleaning

Cooling air is carried through the heat-exchanger tubes with sufficient velocity to expel practically any kind of dirt. If oily or sticky dirt should cling, tubes can be ramrodded clean in a few minutes because tubes are straight and tube ends are exposed.

Choice of Corrosion-resistant Materials

You can lick corrosion with this motor, too. Tubes are available in a variety of materials to meet practically any corrosive atmospheric condition. Allis-Chalmers tube-type motors have long and successful experience in such difficult applications as caustic plants, refineries and petrochemical plants, power plants with fly ash problems and many others.

Next time you need a motor for a dirty or corrosive location or for outdoor operation in all kinds of weather, call your Allis-Chalmers District Office. Get complete information on Allis-Chalmers tube-type totally-enclosed, fan-cooled and explosion-proof motors. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7149. Available in ratings on frames larger than NEMA 505 up to 3000 hp. A-4222

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

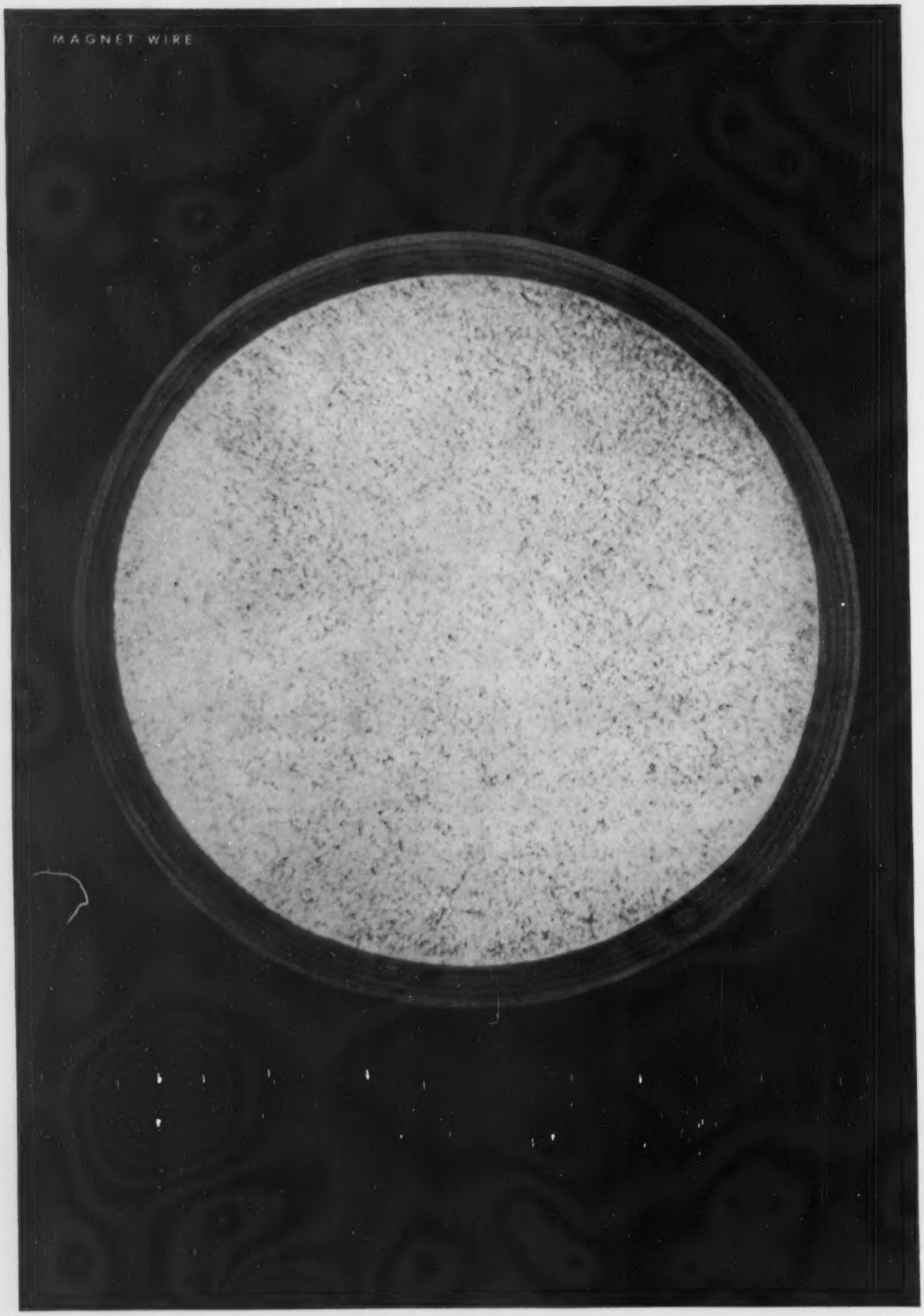
by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS


MAGNET WIRE

A NEW, BIGGER LOOK AT MAGNET WIRE

In Anaconda's independently housed development laboratory—research of today paves the way for better wire tomorrow. And here's how *you* benefit.

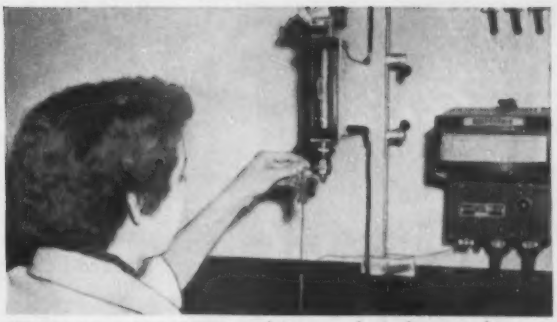
The big picture shows the cross section of a piece of magnet wire – magnified 270 times.

It may not mean much to you NOW – but photomicrographs such as this give us a clue to making better wire for your use tomorrow. They show our scientists *how* the enamel films are applied. And when we know this, it makes it possible for us to make better . . . higher-quality wire.

High-quality wire, in turn, means improved products for magnet wire users. And, equally desirable – lower costs on your production line.

Many customers have bought ANACONDA wire for more than 25 years. Many, too, have eliminated incoming inspections! This, we feel, is tangible evidence of what Anaconda's constant emphasis on quality means to the user.

Have you a problem involving magnet wire? Then talk it over with your Anaconda Representative. We'll give it prompt attention. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.* 54428



NEW FACTS ON SOLDERING. This research worker is making one of thousands of tests to determine proper pot temperatures and immersion times for soldering magnet wire. As tests by hand methods are difficult to make and often unreliable—Anaconda's collection of apparatus is a valuable research tool for making solder tests under *known* and *controllable* conditions.

WHAT HAPPENS TO WIRE IMMERSED IN FREON-22? This refrigerant gives twice the cooling effect of Freon-12. But what does it do to magnet wire in sealed motors? This photo shows the way Anaconda finds out. Formvar is put in a "bomb" filled with Freon-22. Temperature is raised to 105°C (pressure over 800 lbs.). Result? No breakdown of insulation under testing.

NEW PERFORMANCE CODE FOR INSULATION. AIEE Standard No. 1, adopted June 1947, classified materials on basis of chemical composition. This was all right when there were few materials to classify. Now there are hundreds, so a new performance method is felt to be preferable. Anaconda is participating in the test program being conducted by the Institute. Here, an operator measures the power factor and dielectric constant of enameled magnet wires over a range of frequency and temperature.

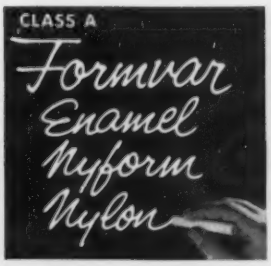
ANACONDA®

TODAY'S HEADQUARTERS FOR MAGNET WIRE

*Reg. U. S. Pat. Off.

A COMPLETE LINE:
ANY TYPE, SIZE OR SHAPE

— round, square, rectangular —
Your special needs will be given special attention



The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

Self-Service Pay Stations

(*Continued from page* 192)

Additional depositories will be installed as required in areas where community growth and customer demand indicate the need for additional service. Installations are usually made on a low-cost, lease-rental plan in stores where major electric appliances are featured. This method retains control of the depository by the utility.

Location in the store is chosen so that the depository is easily accessible, near a cash register, can be seen from the street, and can be fastened to the floor for maximum security. Dealers are selected who maintain convenient daytime and evening hours, including Saturdays. Location of depositories is marked by a metal sign on the outside of the dealer's store.

LAMP BUILDING COMPETITION is under way by students of Newburgh (N. Y.) Free Academy under the guidance of the school's woodworking supervisor. The contest is among high school students (an estimated 2,000 students) in Central Hudson Gas & Electric Corp area

Central Hudson Continues Lamp Building Competition

Central Hudson Gas & Electric Corp, Poughkeepsie, N. Y. opened its fourth annual lamp building competition for high school students in the company's franchise area last fall. All high schools equipped with a metal or woodworking shop under the direction of an industrial arts supervisor were eligible to participate. An estimated 2,000 industrial arts students in 35 area high schools are included in the lamp building activity.

To be eligible for the competition students have been requested to construct lamps in accordance with specification furnished by Central Hudson but design and originality should be of the students' own planning and ingenuity.

The competition was open from October 15, 1953 to March 1, 1954 and prizes were awarded to builders of the top three lamps in each school selected by local judges. The first award winning entries in each school will be assembled for the grand award judging by lighting specialists. Local judging was finished by March 15, 1954 and the final judging of local winners will be conducted the week of May 23, 1954.

(*S&S continued on page* 209)

J. E. Barkle, Manager, Westinghouse Electric Utility Engineering Department.

In his 15 years with Westinghouse, Jack Barkle has been personally associated with many developments in power system communication and control. He has achieved widespread recognition for the application of these developments to individual utility problems.

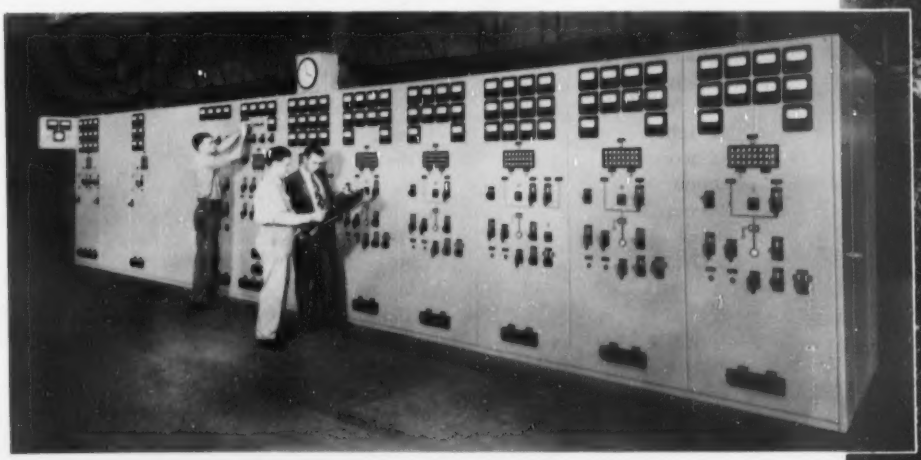
The economic application of system control and communication

Whether your primary interest is in automatic operation, control or protection . . . or all three . . . Westinghouse is in a unique position to serve you. As a manufacturer of all types of controls, protective devices and interconnecting communications, Westinghouse has no ax to grind for any one type, except the obvious:

To assist in finding the best answer to your individual system requirements.

And in that, Westinghouse has a big stake. Westinghouse shares with you a community of interest that extends beyond individual products. All your problems, however, must be solved by the application of these products.

On the following pages, Westinghouse experts set forth the tangible benefits of products designed to work together, right from their inception on the drawing boards, to attain maximum efficiency with economy.



Westinghouse FR-FJ microwave equipment during final assembly. Bob Cheek, Assistant Engineering Manager, Electronics Division, points out FR-FJ microwave's building block construction . . . one of its many flexibility features.

Communications systems with coordinated end-use devices effectively meet every requirement

Most utilities today take advantage of power line carrier or microwave, or plan for it in their future growth. In this, Westinghouse is well-equipped to meet individual system requirements with (1) Type FD power line carrier, (2) Type FR-FJ 2000-megacycle microwave, and (3) coordinated devices for voice communications, telemetering, supervisory control, relaying, and other functions.

The basic consideration of whether carrier or microwave—*or both*—will best satisfy your individual needs is economic. Carrier costs vary greatly with the number of channels; microwave costs with distance. In general, carrier has the cost advantage for a smaller number of channels over longer lines. Conversely, microwave has the advantage for a large number of channels over relatively short distances.

Other considerations, too, are important. For example, there is a practical limit to the number of carrier

channels that can be applied to any given transmission line, regardless of the distance involved. Microwave, on the other hand, can easily provide many more channels than are needed for most applications. Also, microwave is completely independent of power lines, which means it can convey intelligence between widely dispersed locations, even though some, or all of them, are remote from the power lines.

Westinghouse FD carrier features

. . . Voltage regulation
. . . D-c operation
. . . More channels

The importance of reliability to the individual utility cannot be overstated. For that reason, all Westinghouse FD carrier assemblies include voltage regulators that automatically assure correct voltage on the tube filaments. This exclusive feature is especially important in relaying, where dependability of vacuum tube action must not be hampered by lowered line voltages. The dependability of FD voice assemblies has also been increased. These operate directly from 60- or 120-cell station batteries—the only carrier with this advantage. A-c assemblies are also available.

The unusually high selectivity of FD carrier receivers allows channels to be spaced closer together, permitting a greater number of voice and telegraph services. Also, FD carrier spectrum is wide-range—40 to 200 kilocycles. Both features add up to more channels for greater usefulness, today—or for future expansion.

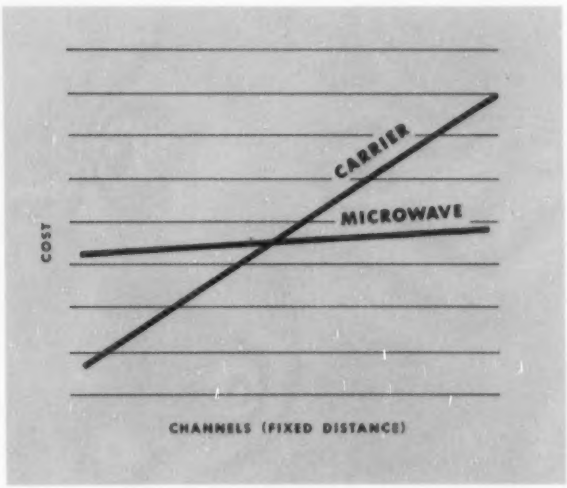
Westinghouse FR-FJ microwave

. . . Most flexible multiplexing system available.

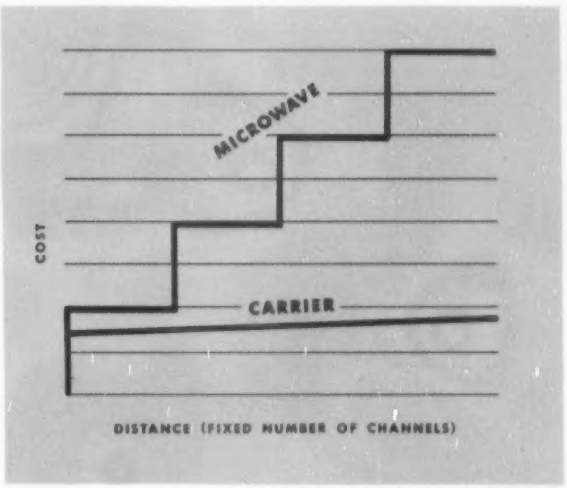
FR-FJ 2000-megacycle microwave is especially designed for the heavy requirements of electric utilities. Up to 30 duplex voice channels are provided. Each of these 30, when used for telegraph alone, can handle as many as 15 telegraphic circuits.

For utmost reliability, each of the 30 voice channels is strictly independent. If one channel develops a fault, all others continue without interruption. That's because the Westinghouse FJ voice band multiplex panel is self-contained—*even including its own power supply*. Only Westinghouse microwave offers such extensive assurance of reliability. Each of the 30 voice channels is crystal controlled. The result—stabilized coordination over wide ranges of input voltages, temperature, and other variables.

Type FR radio and Type FJ multiplex assemblies use only four basic panels each. These panels are complete-



This chart shows the general comparison of carrier and microwave initial costs, relative to the number of channels. Note that carrier's cost is definitely influenced by the number of channels required. Microwave's cost is usually influenced much less.



When referred to distance, a general comparison looks like this: Microwave's cost is strongly influenced by distance, because of the necessity for repeater stations as distance increases. Carrier's cost is not usually affected as much by distance.

Westinghouse

ly adequate for all radio and multiplex functions. System modification, parts stocking and maintenance are thus reduced to simple terms.

A single FJ voice band panel is usable for any of the 30 voice channels. Each voice band panel is adaptable to party-line or private-line service; to two-wire or four-wire termination; to all types of signaling. Party-line service requires no additional equipment, and is free of complicated circuitry. Built-in signaling allows immediate push-to-talk operation of remote VHF base stations.

• • •

Frank Ludemann, Microwave Application Engineer, with a complete station of Type FR microwave radio and Type FJ multiplexing equipment. This modern equipment provides up to 30 voice or 450 telegraphic channels.

Complete Westinghouse systems include

. . . Built-in protection

. . . Provision for additions

FR microwave assemblies include a service channel and alarm panel. The service channel provides a telephone circuit connecting all stations, available for use *at the radio equipment* for service and maintenance communication. The alarm feature, an optional addition, provides automatic reporting of off-normal conditions at all stations.

A new wide-range sleet detector in FD carrier relaying assemblies checks operating conditions of the entire channel.

FD carrier is built on a "building block" basis—coordinated basic units that afford maximum flexibility of installation, and in subsequent alteration to meet system growth.

Installation of FR-FJ microwave is available on a turn-key basis, including surveys, design, construction, buildings, and maintenance. Undivided responsibility is your assurance of highest efficiency and economy in your intelligence communication system.

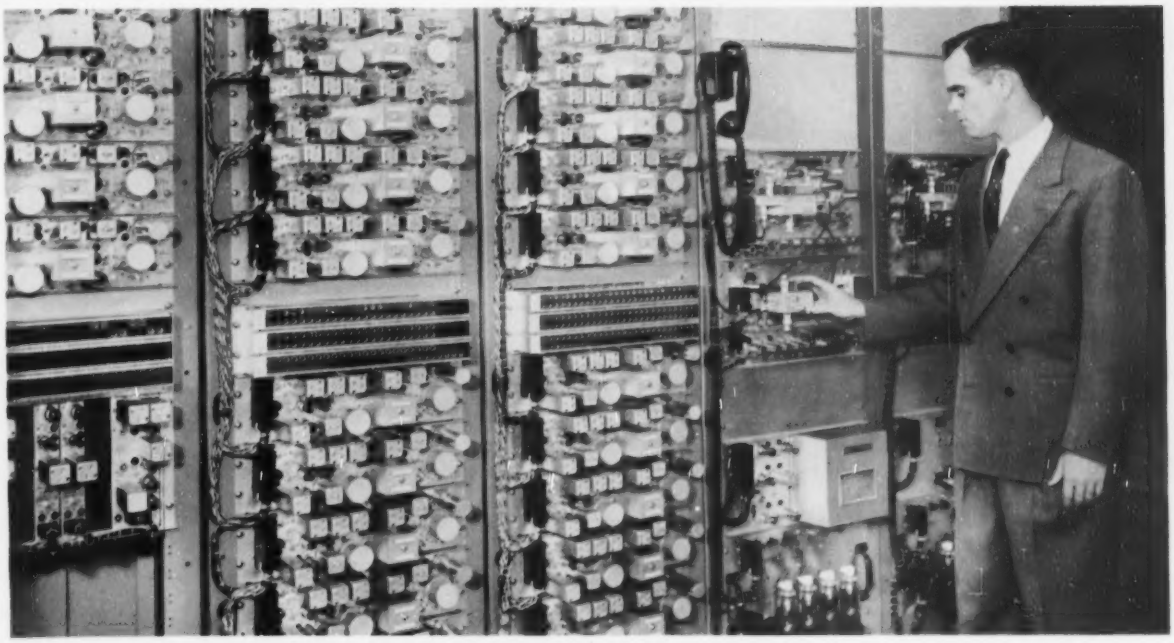
Fast, reliable conversion of data for transmission is another factor that requires careful selection of the right equipment. For this function, Westinghouse developed Freq-O-Tron* telemetering.

*Trade Mark

• • •

FD power line carrier. Jim Booth, Carrier Application Engineer, demonstrates the highly efficient swinging rack construction that quickly exposes all panel fronts for easy, safe tube checking and routine testing. For complete access to *all* parts, front and back, the rack swings free of the door on its own hinges . . . an important contribution to better, faster maintenance.

FR-FJ 2000 megacycle microwave with multiplexing. The racks on the left contain FJ multiplexing equipment . . . the two on the right, FR microwave radio. Note the neat building block construction, using plug-in unit assemblies and standardized cabinets. This is a significant advantage for installation and maintenance . . . a big advantage, too, for future expansion and rearrangement.



YOU CAN BE **SURE**... IF IT'S **Westinghouse**

Freq-O-Tron telemetering transmits facts instantly

Not limited to measuring alone, Westinghouse Freq-O-Tron can transmit any data that can be converted to a proportional d-c millivolt equivalent, including position indication or pressure. It can employ any medium: microwave, power line carrier, or pilot wire.

For the average system intelligence function, such as load dispatching, its exceptional speed is more than adequate.

The Freq-O-Tron system is ideal for totalizing. Since all quantities are reduced to proportional d-c milli-

John Kendall, Relay Sales Engineer, with IT-1 Freq-O-Tron transmitter. Acting as an electronic generator, transmitter converts d-c millivolts input to a proportional output frequency. Signal can be carried by carrier, microwave or pilot wire.

Modulating signal is detected by this IR-2 Freq-O-Tron receiver, shown with Bill Connolly, Relay Sales Engineer. Receiver converts frequency to proportional d-c millivolts and forwards it to recorder or indicator to reproduce original measurement.

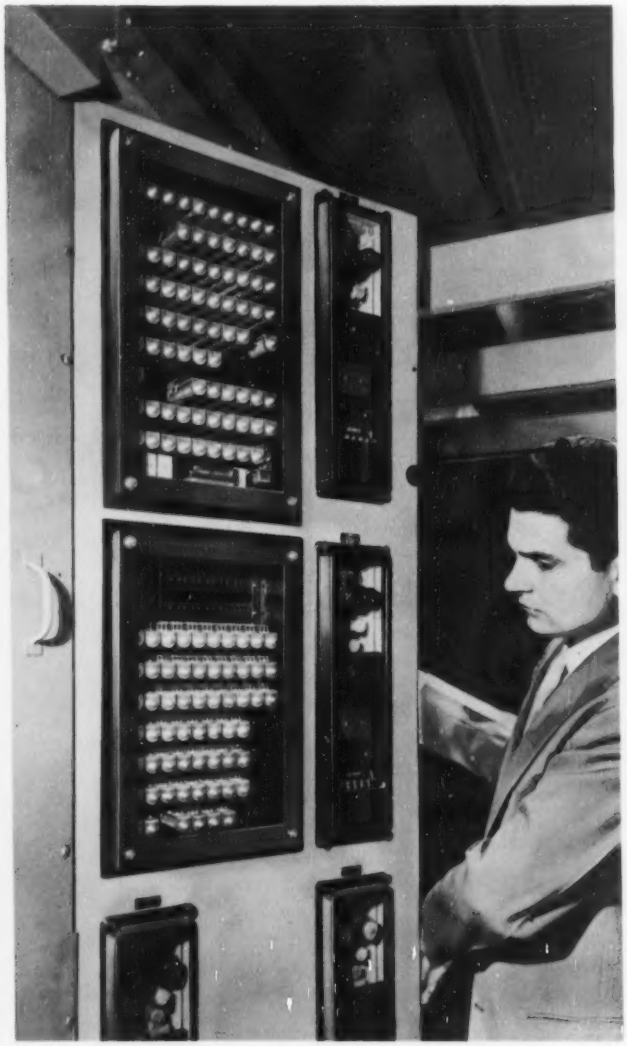
YOU CAN BE **SURE**...IF IT'S

volts, they are added by simple series connections.

Freq-O-Tron telemetering is accomplished in four steps: (1) The primary measurement is made at the point of origin and is converted into proportional d-c millivolts. (2) This quantity is fed to a Westinghouse IT-1 transmitter which converts it to a modulating signal, varying in frequency from 15 to 35 cycles. (3) A Westinghouse IR-2 receiver detects the modulating signal and converts it back to d-c millivolts. (4) A recorder and/or indicator interprets the d-c and reproduces the original measurement.

The transmitter-receiver response is instantaneous (less than 1 second); over-all time for all four steps, including thermal converter and wide-chart, high-speed recorder, is usually well under 3 seconds. Accuracy of the Freq-O-Tron transmitter and receiver is within 2% of full scale.

Freq-O-Tron transmitters and receivers are supplied in Flexitest® cases for projection or semi-flush mounting. The complete chassis may be removed from the case in just a few seconds for inspection or maintenance. Built-in test switches facilitate testing in the case.



Compact design of Freq-O-Tron telemetering equipment permits neat, easy mounting. Exclusive Flexitest case gives quickest access for testing, maintenance, or inspection. Looking over this installation is T. Barabutes, Design Engineer.

Visicode® . . . the most reliable supervisory control

Where the operation of unattended generating plants and substations is a factor in your system, there are many advantages to centralizing control of these stations in one location with supervisory control. Westinghouse Visicode—an "all-relay" type of supervisory control—enables a single operator to exercise continuous control of load dispatching over an entire system, to make rapid decisions in time of system disturbances and to put those decisions into effect almost instantly.

Visicode can be used on any communication system—telephone, carrier or microwave—to control any electrically operated device. It provides lamp indications of the position of devices and telemetered indications of electrical and mechanical quantities.

Automatic check-back makes Visicode the last word in reliability. After a device at a control station has been selected by the operator, the selection is automatically checked and indicated back to the operator *before an operation can be performed on the device.* Visicode cannot perform on incorrect operation, no matter what the cause: control power failure; failure of line wires, carrier channel, or microwave link; or interference of any kind as the result of induction from nearby power lines, lightning, switching surges or other phenomena.

Since Visicode consists entirely of standard telephone-

Westinghouse

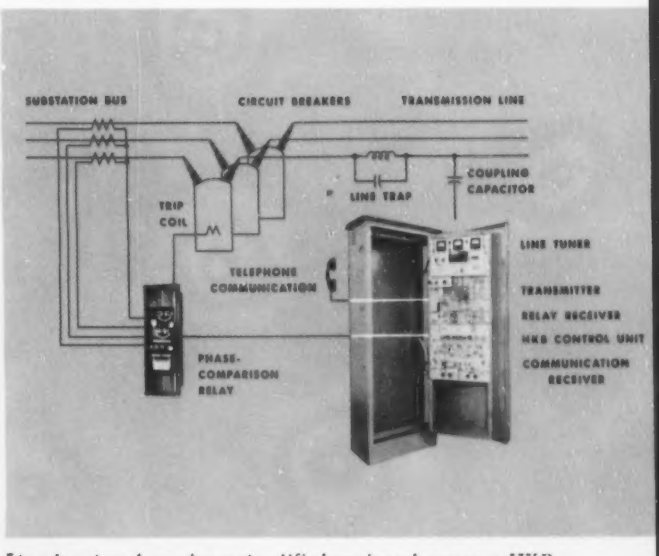
Visicode continued . . .

type relays, very little maintenance is required. Inexpensive narrow-band telegraph channels can be used. Visicode impulses are transmitted at a rate of 15 per second. Simple and inexpensive types of carrier and microwave channels can also be used. And, by completely coordinating Visicode with switchboards and metal-clad switchgear, Westinghouse can save you substantial engineering time and installation expense.

• • •

Westinghouse Visicode supervisory control enables this power company dispatcher to control and supervise the operation of all electrically controlled apparatus in a number of large substations. Centralized remote control means reduced operating costs, more efficient system operation.

YOU CAN BE **SURE**.. IF IT'S



Line drawing above shows simplified carrier relay system. HKB phase-comparison relay compares phase position of currents at terminals of line section to determine whether fault is internal or external to section of line protected.

HKB provides complete phase and ground fault protection. Operates on line current only—no potential transformer required—not affected by out-of-step conditions. Pictured with H. W. Lensner, Senior Relay Design Engineer.

HKB relays . . . high-speed, simultaneous tripping at lowest cost

High-speed clearing of faults on transmission lines by simultaneous tripping of breakers on each end of the fault—made possible by power line carrier and microwave equipment—is highly desirable on key lines. This kind of fault clearing provides stability, continuity of service, quick reclosing, and prevents or minimizes damage to equipment.

Simultaneous tripping in *3 cycles* is possible with Westinghouse HKB relays, whether used with carrier or microwave. These relays are often the most economical for the degree of protection and fast reclosing they make possible.

Stated briefly, HKB relays may be said to keep track of the direction of current flow in a line section. When no fault exists, current flows through the line in one direction only. When an internal fault occurs, current flows from both terminals of the line section toward the fault. This two-directional flow is immediately detected by HKB relays which simultaneously open the breakers on each end of the faulted line section.

In cases where carrier or microwave relaying is being added to a line and existing relays are used for backup protection, the HKB system affords substantial savings over other carrier or microwave relaying systems. It also saves valuable switchboard space, since fewer relays are required in the complete HKB system.

Another relatively new HKB relay feature is the use of vacuum tubes instead of thyratrons in the control unit for continuous grid control—surer action. Vacuum tubes may be tested on a regular maintenance schedule with conventional tube-testing equipment. They may be easily replaced at the first indication of aging—thus eliminating sudden failures.

Westinghouse

Here, Ralph Marbury, Manager Capacitor Engineering, points out an exclusive Westinghouse line-trap feature—heavy-gauge, nonmagnetic steel end brackets which will withstand forces imposed by fault currents and mounting stresses.

New line-trap design permits high fault current applications

Westinghouse line traps can now withstand higher fault currents than ever before—and provide improved carrier performance, as well. The new coil design and molded bar construction permit extending the short-circuit rating to 36,000 amperes in the 1200-ampere size. This same advance design has been extended to the 400, 800 and 1600-ampere line traps—the most complete line available today.

Westinghouse line traps work four ways to improve carrier performance: (1) Extend its use by reducing the effect of transmission path distortion upon carrier channels. (2) Increase its effective range by reducing the loss of carrier power in connected lines not being used for carrier communication or relaying. (3) Permit normal carrier operation when lines are grounded for 60-cycle power. (4) Assure the reliability of carrier channels even under system disturbances caused by short circuits, grounds, or switching phenomena on connected lines.

The new Westinghouse design is more compact in size — permits smaller phase spacing — saves valuable space in crowded substations. Terminal connections are attached to extra-strong end brackets (see cut). This arrangement prevents short-circuit forces from being transmitted to the coil conductors. Plastic barriers prevent birds or objects from entering and short-circuiting the coils. The traps are easily tuned to any desirable channel without removing the tuning units.

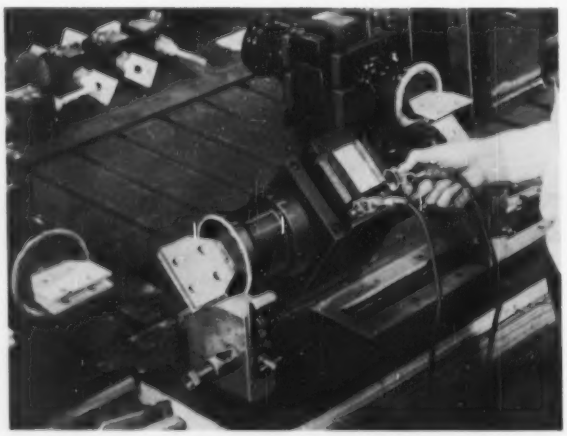
Instrument transformers . . . vital link to system reliability

The reliability of any system of communication must first of all depend upon the continuing ability of its instrument transformers to provide an accurate power source to the control circuits of its metering and relay devices.

To prove beyond any question that this essential reliability actually exists in its instrument transformers, Westinghouse subjects them to 194 rigid tests covering raw materials, subassemblies and completed units.

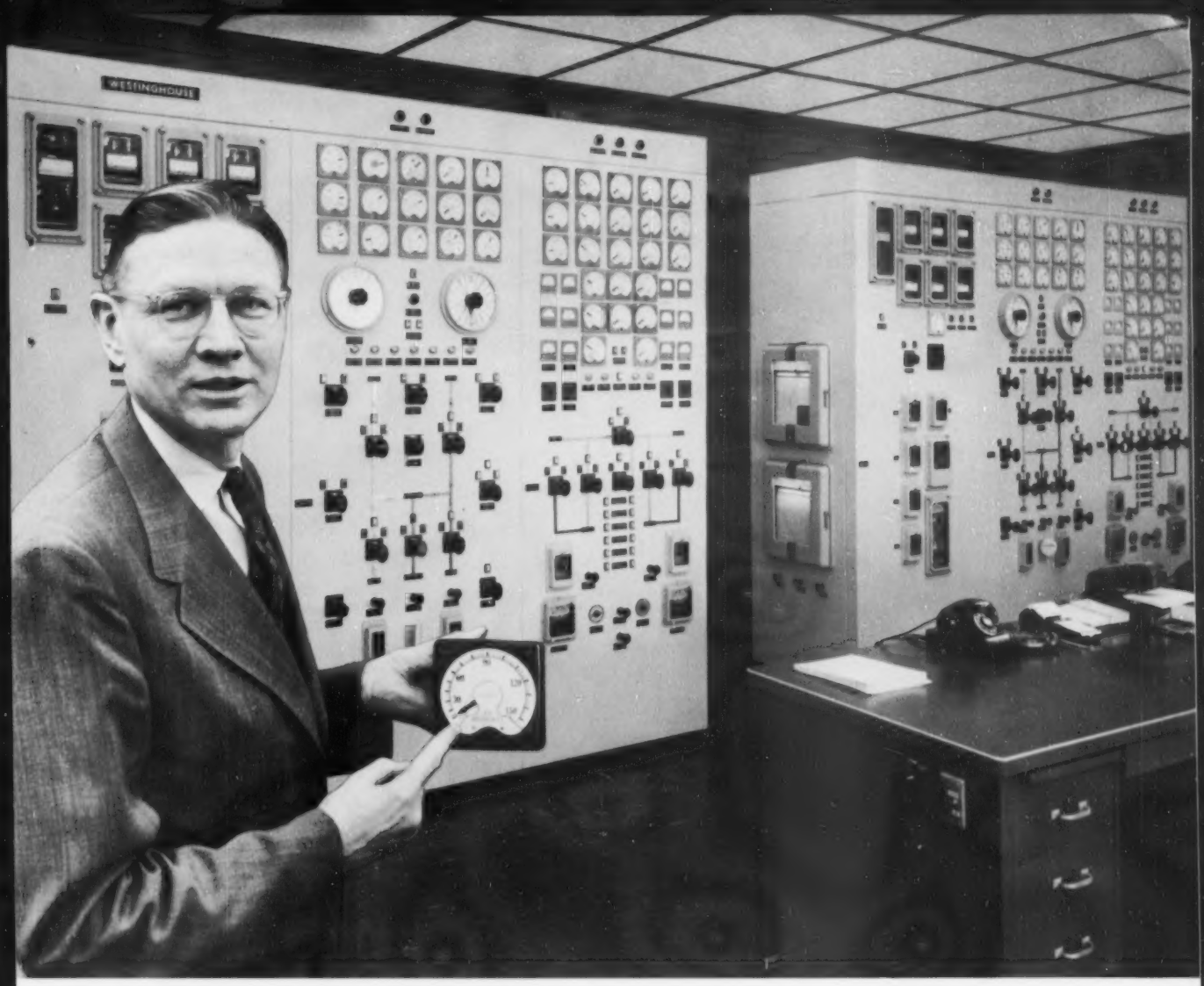
For instance, every Westinghouse instrument transformer is tested to assure accuracy and long-term dependability for every one of these five vital characteristics:

1. **Turns ratio**
2. **Dielectric strength**
3. **Induced potential strength**
4. **Ratio and phase angle (illustrated)**
5. **Polarity**



A Westinghouse current transformer being tested for ratio and phase angle.

YOU CAN BE **SURE**...IF IT'S



Demonstrating the superior readability of these K-24 instruments is Larry Lunas, Supervising Engineer, Instrument Section.

K-24 instruments . . . readable from 20 feet . . . from angles of 65 degrees

Electrical data gathered by telemetering is highly important—and errors can be costly. Westinghouse K-24 full-view, circular scale instruments are designed to help eliminate these errors because they are so easy to see — from distances greater than 20 feet — or from angles up to 65 degrees.

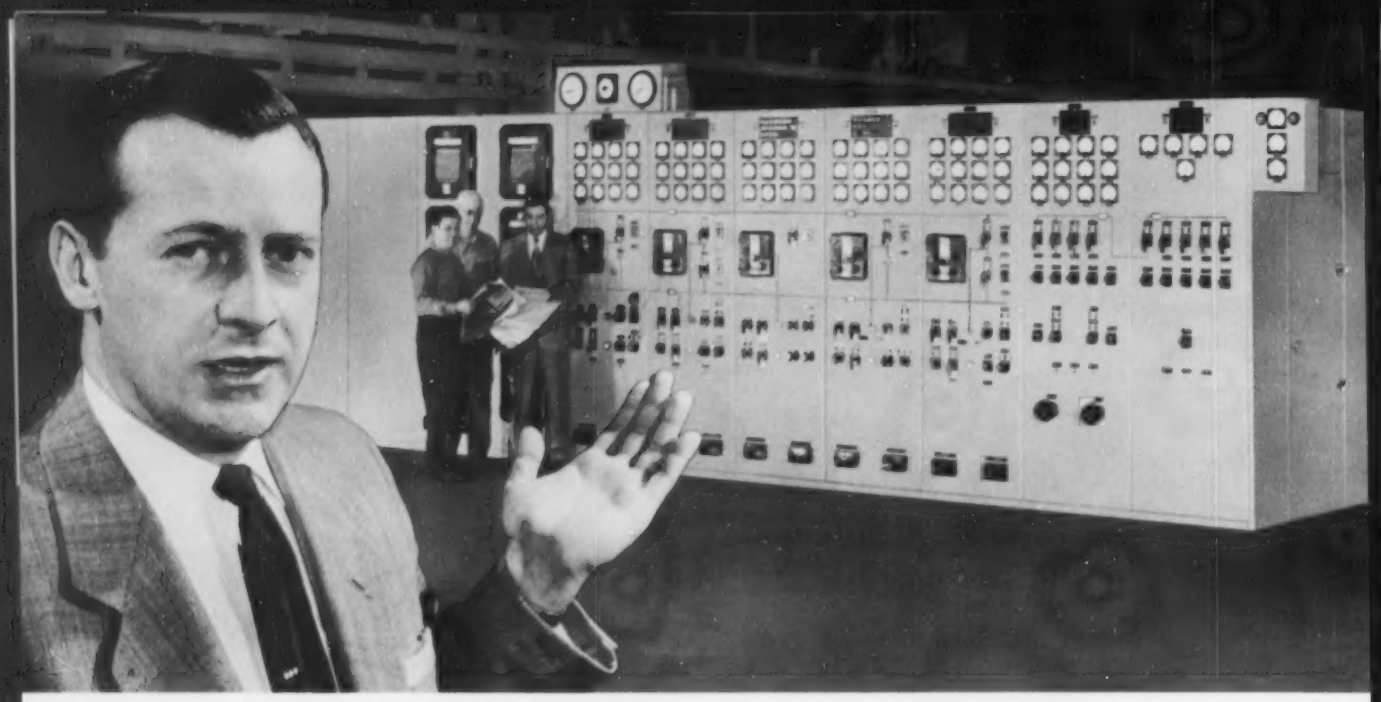
They are shadow-proof and glare-proof, too. The unique dial design takes advantage of proved optical principles to assure complete visibility under all lighting conditions.

Legibility like this means that K-24 instruments do not have to be spread out at a low level on the board. They can be grouped compactly in higher banks, thus saving space. One man operation is simplified.

K-24 instruments have nonaging springs—preaged permanent magnets and a permanently white, indestructible dial. Special processing and rigid quality control procedures assure low-friction pivots.

When used for telemetering applications with Westinghouse Freq-O-Tron equipment, K-24 instruments greatly reduce chance of human error in reading the electrical data so important to system efficiency.

Westinghouse



Westinghouse control switchboards are modern in appearance, functionally laid out. They are highly accessible for inspection and maintenance—offer maximum safety to operating personnel—can be easily extended at either end.

Control switchboards provide centralized operation

There are many advantages to centralizing your communication and control equipment in functional Westinghouse control switchboards. In one location, you can combine all the control, indicating, recording, regulating, and protective equipment needed to operate a generating plant, substation, or remote stations. Control switchboards are simple to operate and maintain—can be easily expanded to grow with the system. And, through Westinghouse coordination and supply of all equipment for the complete job, you gain one-manufacturer responsibility—save substantially on engineering work and installation expense.

Westinghouse control switchboards are compact, factory-assembled units that can include protective relays, carrier or microwave interconnections, supervisory control and telemetering instruments — plus all the necessary auxiliary devices. Westinghouse engineers can tailor your installation from eight basic switchboard designs — standardized by NEMA: vertical, enclosed, dual, and duplex switchboards; control desks; benchboards; dual and duplex benchboards.

Westinghouse switchboards maximize the effectiveness of your communication and control equipment. Through them, you can create a highly efficient operations center that can give you finger-tip control, concentrated in the hands of your most skilled operators.

CP-1015

YOU CAN BE **SURE**... IF IT'S **Westinghouse**

If you'd like further information, you'll find your Westinghouse representative ready and anxious to serve. Or, if you prefer, the booklets listed below can be obtained by writing direct to Westinghouse Electric Corporation, 3 Gateway Center, P.O. Box 868, Pittsburgh 30, Pennsylvania.

☐ Power Line Carrier	B-5873
☐ Microwave	B-5850
☐ Freq-O-Tron Transmitter	IL 41-810.1
☐ Freq-O-Tron Receiver	IL 41-810.3
☐ Visicode Supervisory Controls	DB 32-450
☐ HKB Relay	IL 41-650
☐ HKB Carrier Relay System	IL 41-600.3
☐ Line Traps	DB 49-620
☐ K-24 Instruments	CS 43-200
☐ Instrument Transformers	PL 45-000
☐ Control Switchboards	DB 32-500

Name_____

Title_____

Company_____

Street_____

City_____ State_____

CP-1015

New Electrostatic Air Cleaner

A room-sized air cleaner that is stated efficiently to strain out smoke, pollen, dust, lint and even many types of germs, was recently announced by Raytheon Manufacturing Co. The new device, named "Micronaire", quickly rids the air of these impurities, which are trapped by the electrically charged parts of the machine's filtering unit. It will be shown this June at the annual convention of the American Medical Association, and later at various state medical society meetings.

Field testing has been carried out for several months with the help of physicians and allergy sufferers at home and in hospitals and the company states that it has amassed an impressive amount of data supporting the effectiveness of the machine in relieving the symptoms of hay fever and asthma.

The "Micronaire" unit weighs 60 lbs, and is mounted on castors for easy wheeling from room to room. It is 30 in. high, 15 in. wide and deep. There is no installation required. The machine is merely plugged into a wall outlet and operated, like a small radio. Production of the device has begun, and is expected to reach mass volume by early fall. Raytheon hopes to keep the price "under $250", and announced that it is being sold through 175 medical supply houses throughout the country.

60 Days—$60 Million

"$1,000,000 of appliances every day for 60 days." That's the goal of a new spring sales incentive campaign designed to move some $60,000,000 in appliances from retail store into consumer homes beginning May 17, John F. McDaniel, vice-president, Hotpoint Co announced recently.

Spearheading the promotional sales drive will be in the introduction of two new appliances; a spring special electric range, and a new maple top mobile dishwasher.

McDaniel said that the promotion, "Trade Parade," was created with four purposes in mind—increase consumer product identification, increase consumer identification of a dealer's store, increase dealer store traffic, and, increase dealer sales.

STEP UP YOUR SAVINGS and EFFICIENCY with the...

YORK-HOOVER

Model 4986

SERVICE BODY

Realize those *extra* dollars by investing in York-Hoover Body Equipment. Model 4986 Service Body, for example, is providing outstanding every-day service records in all sections of the country. Built in stability assures an absence of troublesome detail repairs, so costly in terms of time and money.

Model 4986 Body is actually a "mobile stock room" having specially designed—from experience—bins, drawers, and compartments for carrying material and tools. Easy access, and in plain view for inventory purposes, parts and tools are always there when needed. This assures increased efficiency as well as additional savings—always important in your operation.

Functional use is enhanced by the addition of an aerial ladder, one man operated, with minimum effort.

Facts are available—Bulletin No. 934 provides them. WRITE TODAY!

York-Hoover Corporation

YORK, PENNSYLVANIA

Body Division

NEW EQUIPMENT

System Outage Monitor

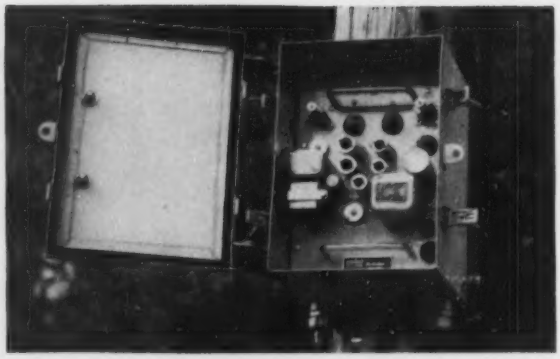
Outage monitor permits simultaneous monitoring of up to 50 separate circuits on a distribution system. The Moduline system consists of a pole-mounted transmitter at the power source, modulators at points to be monitored, a pole-mounted receiver, and an indicator unit.

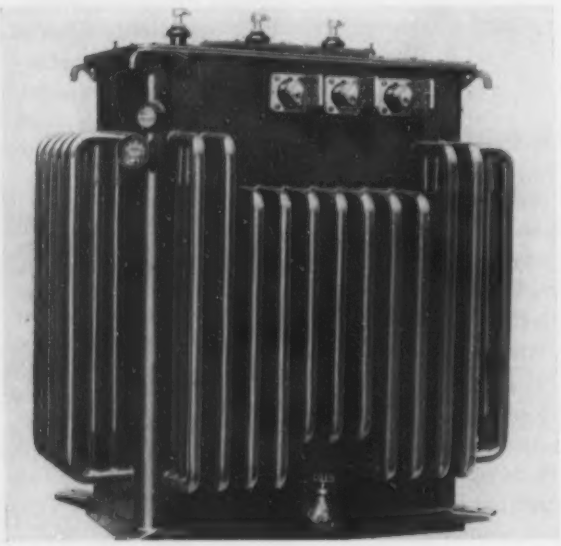
In operation, the crystal-controlled transmitter continuously feeds unmodulated carrier energy into the system on a frequency between 50 and 150 kc.

Each modulator (illustrated) superimposes a different audio-frequency signal on the carrier supplied by the transmitter. Receiver is tuned to the transmitter frequency. Received tones are supplied to the indicator over a 2-wire audio line.

Indicator unit consists of frequency-selective channels, one for each audio tone. An audio tone received energizes the appropriate green light associated with the channel. When an outage occurs, the tone is not received, and a red light is energized in place of the green. A buzzer sounds when any change in indication occurs and sounds until manually turned off.

Sprague Electric Co, North Adams, Mass.





3-Phase Transformers

Three-phase distribution transformers are rated 112½, 150, 225, 300, and 500 kva and standard voltages through 14.4 kv. Round-wound coils are on each leg of core. Claimed advantages are good cooling, light weight, short-circuit strength, impulse strength, low exciting current, and high short-time overload capacity.

Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.

Pole-Moving Tool

Pole-moving safety-bar tool is used in conjunction with a pole derrick to handle light- and medium-weight poles. Tool keeps pole under control when pulling and moving, reducing hazards, especially when working on hot lines.

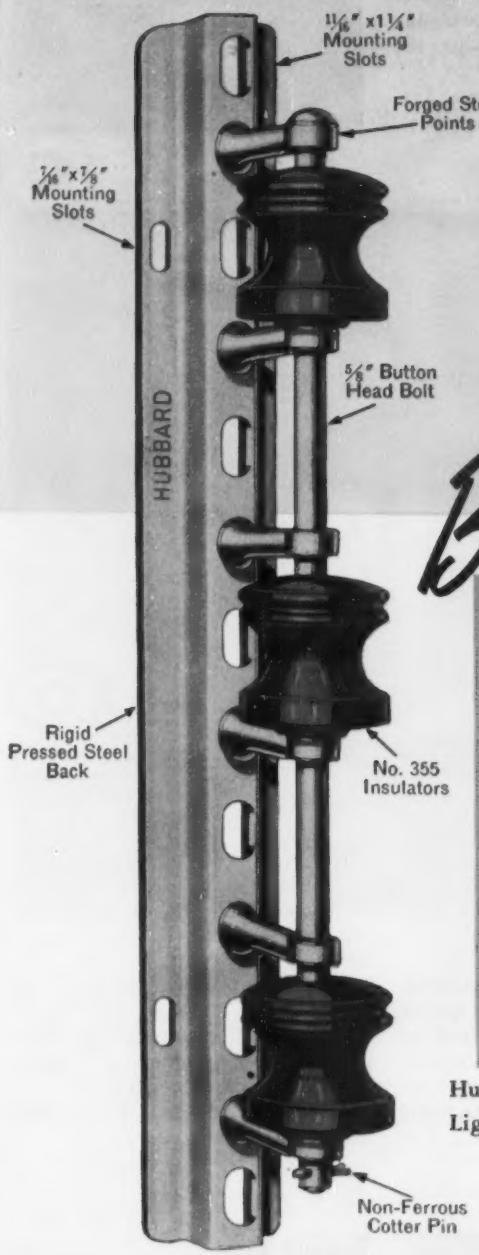
Head section of tool has chain and eccentric binder for a firm lash to pole. Extension-type legs mount on rear of truck. Complete tool weighs 84 to 170 lb, depending on size.

Four Wheel Drive Auto Co, Clintonville, Wis.

Automatic Billing Machine

Automatic high-speed printing and accounting machine can produce over 12,000 postcard bills an hour, with name and address printed on one side, and meter readings, rates, dates, and charges on reverse side. In same operation, stub would be punched with account number and amount for purpose of crediting customer's account upon payment, and a separate card made for use of meter reader on his next round. Also, totals for proof and analysis would be provided and, if desired, a register would be furnished

Linemen Like the HUB-RAK



No. 30648

Because....

- The design gives extra strength without extra weight.
- Mounting slots are located to give wide choice of mounting bolt location for easy installation.
- The points are firmly riveted and perfectly aligned for quick insertion of rack bolts.
- Smoothly finished, smoothly rotating insulators make easy work of pulling in the lines.
- Broken insulators are readily replaced.
- Strong construction and double dip hot galvanizing prolong life and reduce replacement to a minimum.

Hubbard Secondary Racks are made in Heavy, Medium, and Light Types, to conform to E.E.I. standard specifications.

This popular size, in non-extended back, is also available in Heat Treated, Solid Aluminum Alloy.

Write for detailed information

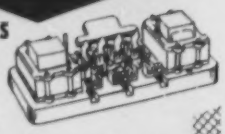
HUBBARD AND COMPANY

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

Recommended
these
METER TESTING ACCESSORIES
Now in use by Leading Utility Companies

PHASEFORMERS



ACCURATELY MEASURES REACTIVE POWER: when properly connected to a watthour meter will provide for that meter the proper potentials lagging 90° in phase from the normal circuit potentials, together with a switching arrangement whereby the meter connected thereto can be checked as a straight watthour meter.

TYPE TRF RESISTANCE LOAD

The addition of a current operating fan on this item is to aid the natural draft condition and make possible a maximum capacity of 24 amperes load current at 240 volts in an aluminum case.

ROTARY TAP SWITCH

ALL INCLUSIVE FEATURES: high current capacity, non-arcing, high voltage capacity, inductive load capacity, numerous circuit combinations, special high current connections, positive action, compact design, fully enclosed.

METER TEST BOARD

So many requests have been received to provide a packaged, up-to-date, compact meter test board unit, we are presenting this equipment which has many features for efficient operation.

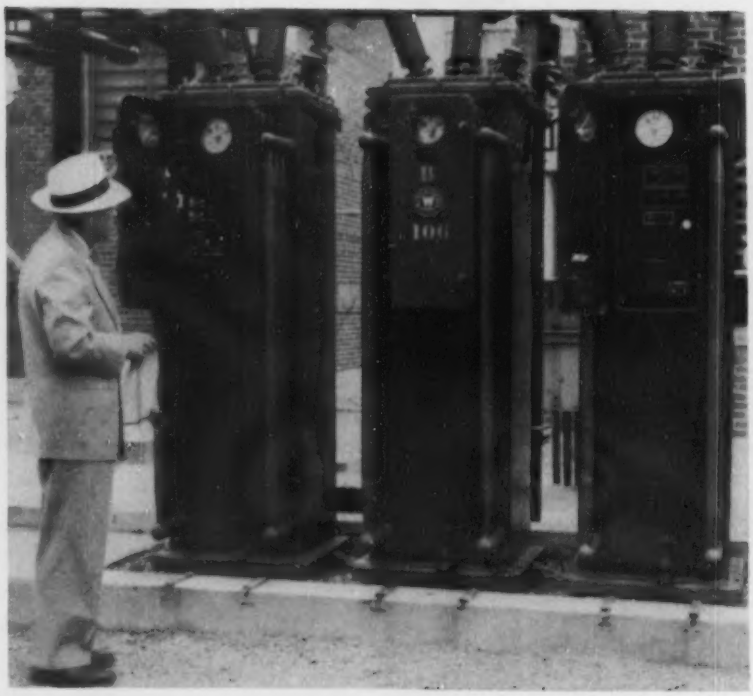
Write for Complete Information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

containing all the billing information.

Series G accounting machine prints at a speed exceeding 43,000 characters a minute. High-speed punching can be done in same operation. Machine will feed and read two separate files of standard 80-column tabulating cards without merging or collating the cards.

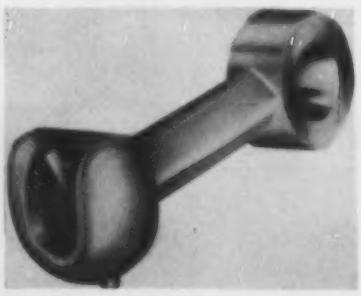
Burroughs Corp, 219 Fourth Ave, New York 3, N. Y.



Induction Regulators

Single-phase induction regulators, 37.5-125 kva, are designed for quieter operation at normal loadings and increased ability to resist mechanical damage on short-circuit currents. To limit amplitude of vibration, torsional resonance of rotor and stator is well below 120 cps. Rotor and stator are supported at the top and rigidly coupled together through a worm drive. Vibration transmitted to auxiliary apparatus is reduced.

Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.



Socket Eye

Socket eye, BT-3058, is for dead-ending ball-and-socket single suspension strings to standard compression dead ends. By varying eye boss and hole diam, eye can be adapted to fit all dead ends, holding 1/0 through 1,590,000 CM ACSR. Eye is 5½-in. long to fit fog-type or standard suspension insulator. Ultimate strength

DOW

PENTA

clean wood preservative makes poles better neighbors ... and protects them against termites or decay

THE DOW CHEMICAL COMPANY,
Dept. PE 746B, Midland, Michigan

☐ Send me free booklet, "Pointers on PENTA."

☐ Send me a list of PENTA-treating plants.

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

This pole, "home base" for neighborhood "hide and seek", was treated with *clean* PENTA*. Poles with a clean PENTA treatment installed in city areas meet the most strict civic requirements, and win the community's good will.

An equally important, and even more tangible benefit: PENTA-treated poles and crossarms have *measurable, effective protection* against decay and termites. Users save thousands annually in avoiding premature replacement costs. And linemen know there's a *lot* of difference in working on a pole that's had the benefit of *clean* PENTA treatment.

Over 60 suppliers across the country can provide PENTA-treated poles of carefully controlled uniform quality . . . be sure *you* win friends while saving costs: Ask your regular supplier about clean *PENTAchlorophenol, or write THE DOW CHEMICAL COMPANY, Midland, Michigan.

you can depend on DOW CHEMICALS

DOW

the PHONE with * THE Q-ZONE LICKS NOISE!

*ZONE OF QUIET

The GAI-PHONE
ELECTRONIC TELEPHONE
MAKES COMMUNICATION POSSIBLE IN EXTREMELY NOISY AREAS

Providing dependable telephone service into and from noisy areas *without sound-proof booths,* the GAI-PHONE is operated and connected like a conventional telephone. Designed for dial or manual operation, desk-top or wall mounting, it can be mixed with conventional telephones in the same system. The adjustable transmitter and receiver levels, as well as the adjustable side-tone level, not only assures the greatest operating comfort in noisy areas, but makes the GAI-PHONE very effective over long lines *without repeaters.* Rugged trouble-free design assures long life.

MODEL 200

Designed for wall or column mounting, this model can be used in many noisy locations where a sound-proof booth is not only undesirable but impractical. For example, when equipped with retractile cord (illustrated) and installed on Boiler Control panel, operator's freedom of action and effectiveness are increased greatly.

MODEL 100

Combining all of the GAI-PHONE'S operational features with modern, streamline design makes this model ideal for desk or table top installation.

GAI-TRONICS CORPORATION
READING, PENNA.
A SUBSIDIARY OF GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS

FOR FREE BOOKLET WRITE DEPT. EP

is 35,000 lb. Drop-forged steel is hot-dip galvanized. Weight of eye is 2.30 lb.

Brewer-Titchener Corp, 111 Port Watson St, Cortland, N. Y.

Enclosed Cutout

Porcelain intermediate-duty (PID) 100-amp indicating cutout is rated 7.8-kv, 4,000-amp interrupting capacity. Switch-blade doors are available to convert cutouts to 200-amp disconnect switches.

Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.

Service Connector

Plated, aluminum-bodied service connector will take two conductors, copper or aluminum, 8 solid to 4 ACSR, in any combination. Castings are plated with tin-zinc alloy for low contact resistance. Soft, thick aluminum spacer pad separates conductors, and forms around strands, reducing galvanic corrosion on transfer surfaces.

Fargo Manufacturing Co, Inc, 939 Main St, Poughkeepsie, N. Y.

Capacitor Blocks

Factory-assembled capacitor blocks are for use in open-type banks at transmission, subtransmission, and distribution voltages. Standard block has two rows of 25-kvar, 5- or 8.7-kv capacitor units in parallel in a galvanized steel frame. Available blocks have capacities of 250, 300, 350, 400, 450, 500, 550, and 600 kvar. Individual expulsion-type fuses protect each capacitor. Base insulators are used to insulate banks from ground, and stacking insulators can be used between frames.

Line Material Co, Milwaukee 1, Wis.

Service Truck

Factory-mounted service-utility body, Model A-96, is available on 134-inch-wheelbase R-130 chassis. The 8-ft body is designed for away-from-the-shop service and utility work. Body can be installed on chassis with dual rear tires.

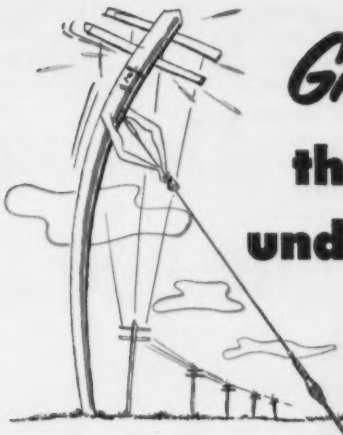
International Harvester Co, 180 N. Michigan Ave, Chicago 1, Ill.

Pulling Machine

Portable, hand-worked hoisting and pulling machine weighs 42 lb and has single-line capacity of 3,300 lb, or with multiple sheaves, up to 10 ton. Each push-pull motion of handle will pull or release cable about 2¾ in., or 10 fpm. Smooth, positive motion allows precision control of load to 0.001 in. in either direction.

Load is held securely and automatically whenever applied motion is stopped. As long as load is applied,

(*Continued on page* 218)



Give the Guy a CHANCE

the NEVER-CREEP pulls against undisturbed earth in machine or hand-bored holes

Circle shows reinforcing plate and rod socket.
The Never-Creep is formed of high strength structural steel, reinforced in area of greatest pull with a high carbon steel core plate.
they've been trying to pull this one out since great grandpappy's days!
MIKE THE MOLE

Once in, they're in to stay!

Pull test after pull test—made for power companies all over the country—show the same result: "Test stopped without failure. There was no damage to the anchor."

And the test of time proves that thousands of Never-Creeps installed for years and years hold more "over the long pull" than any other type of anchor.

Chance Never-Creep Anchors can be installed in holes drilled at an angle by your hole boring equipment. The size of the hole makes no difference in the holding power of the Never-Creep—it pulls entirely against solid undisturbed earth, and is practically unaffected by moisture seepage.

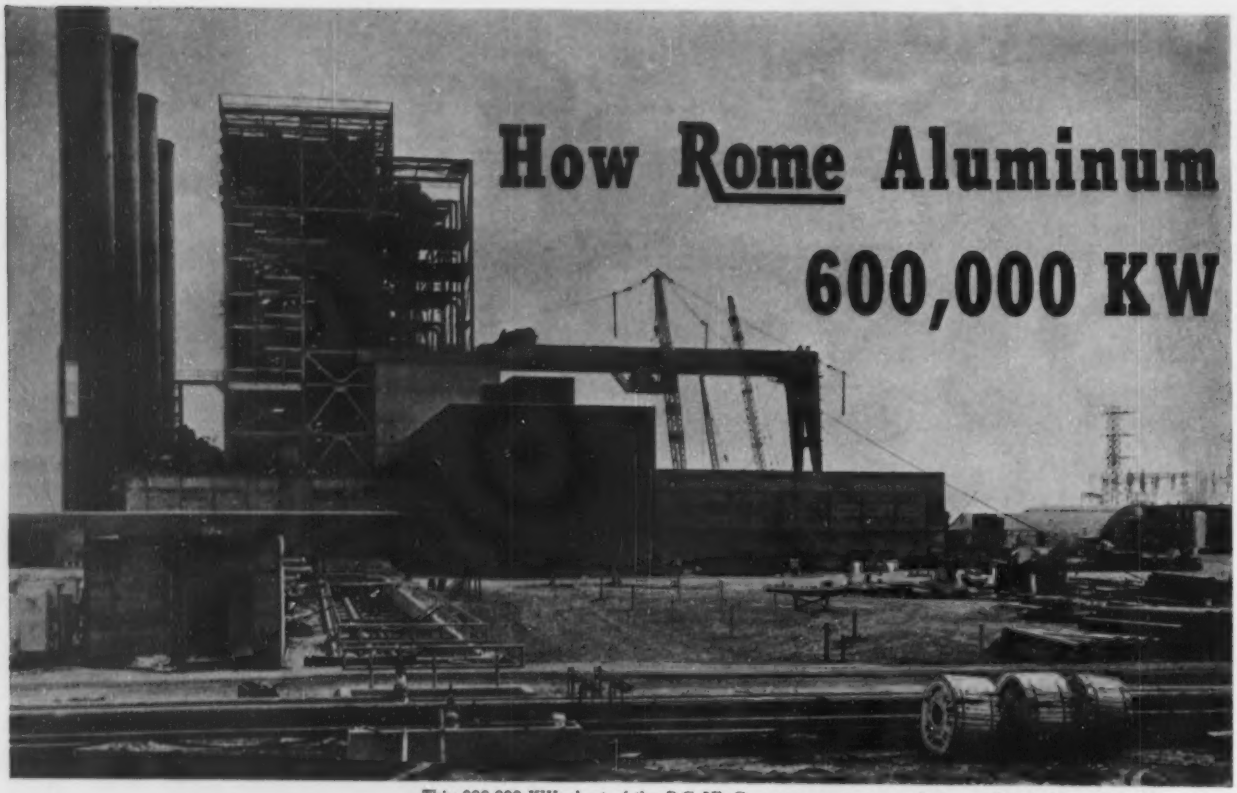
Protect your investment in line construction by specifying Chance Anchors for your guys. The Chance Distributor in your area can probably fill your order from stock. *Specify Chance for Service!*

ABC INDUSTRIES

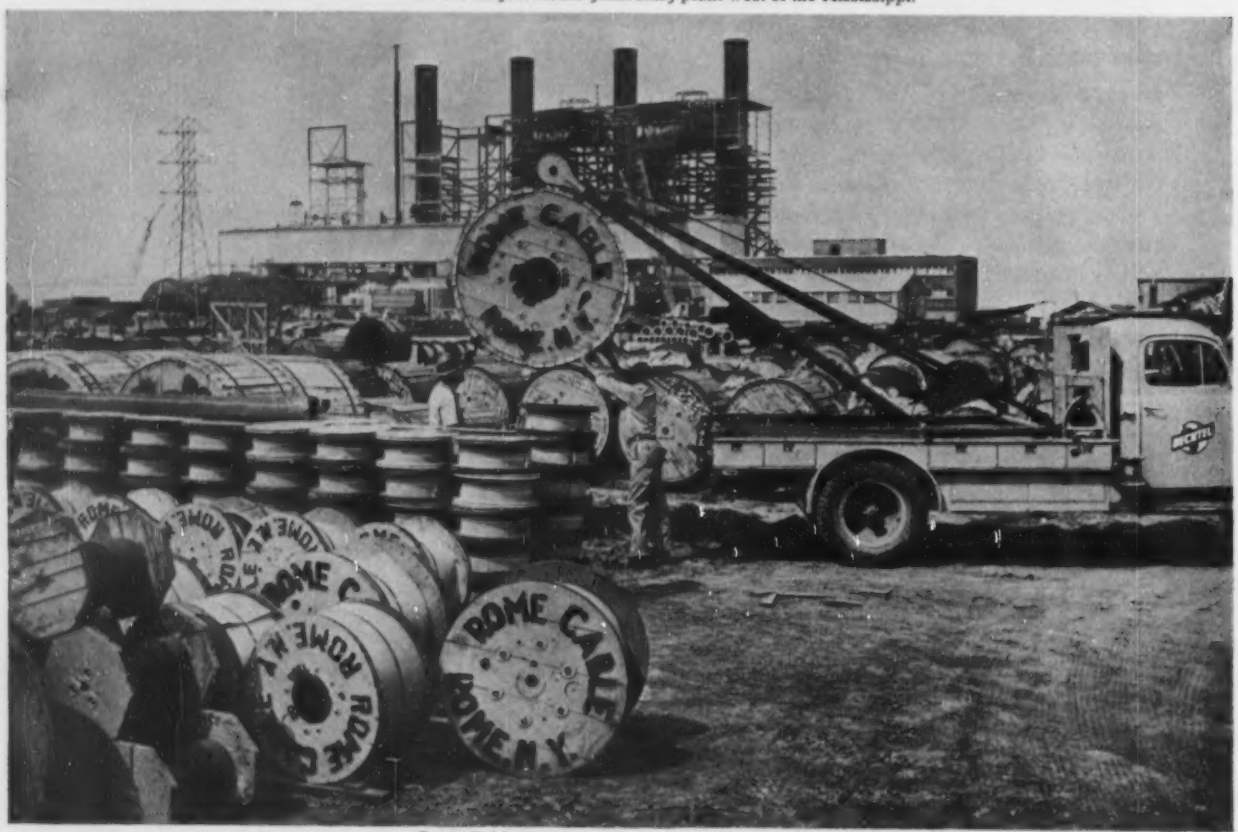
A·B·CHANCE CO.

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS



This 600,000 KW plant of the P.G.&E. Co. now nearing completion at Pittsburg, Calif., will be the largest steam generating plant west of the Mississippi.



Rome Cable made sure its products were at the job site as scheduled by Bechtel engineers.

aids operation of the West's big new power plant at Pittsburg, California

Building ahead of demand to satisfy all requirements for power in the thriving Northern and Central California regions, this new 600,000 KW power plant nearing completion at Pittsburg, California, is another milestone in the $1½ billion postwar construction program of the Pacific Gas and Electric Company.

It's the biggest in the West—an $80,000,000 project.

Engineered and constructed to give adequate, uninterrupted power to this important region, only the most reliable materials and equipment would do. Engineers of P.G.&E. and Bechtel Corporation, Engineering and Construction Contractors on the project, approved Rome power and control cables. Previous experience with Rome cables had been gained in the building of the Contra Costa Steam Plant and other P.G.&E. plants and stations.

Aluminum Power Cables

Miles of Rome "RoZone-RoPrene" aluminum 5KV and 600 volt auxiliary power cables and copper control cables have gone into this new Pittsburg Station.

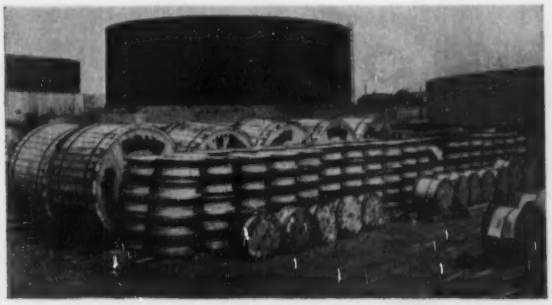
Cables with ozone-resistant insulation and neoprene sheaths were specified for this installation. RoZone is the ozone-resistant oil-base insulation developed in the Rome Cable laboratories for long service under severe conditions. It has excellent electrical properties, and exceptional stability in water. It shows remarkable resistance to ozone, moisture, and heat. Its dielectric strength exceeds 400 volts per mil.

RoPrene is the tough Neoprene sheath that protects these cables so effectively against abrasion and other mechanical damage, and that makes them so easy to pull into ducts and conduits.

Ionization Level Tested

Every foot of Rome power cable rated at 3000 volts or over is subjected to ionization testing as a standard control procedure. In this non-destructive test, devised by Rome Cable engineers, the corona level of the entire cable is measured to make sure that the ionization voltage exceeds the intended operating voltage of the cable. This assures dependable service and long life, with correspondingly lower maintenance costs.

You can have the same assurance of quality and service, by specifying Rome cables. Write today for your copy of the Rome Power and Control Cable Catalog.

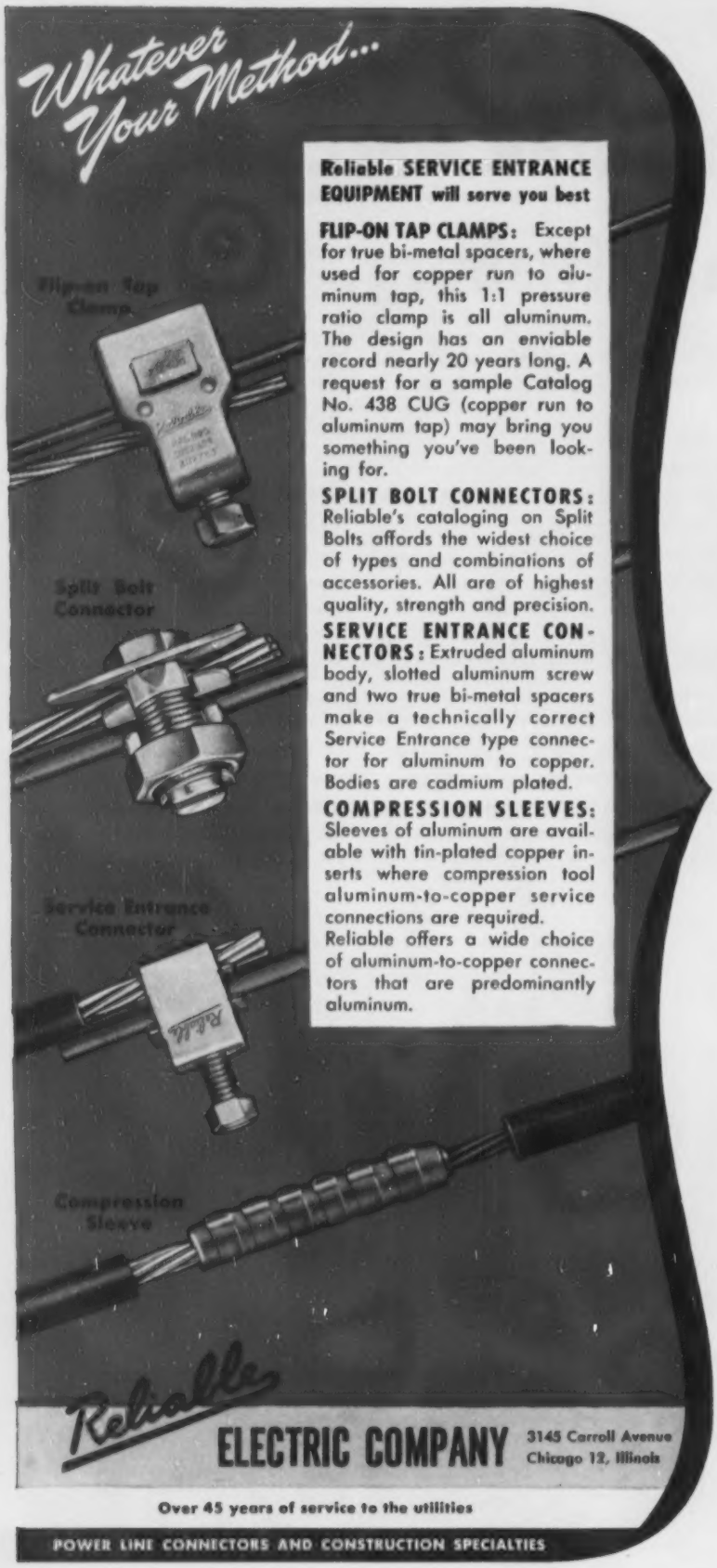


Approximately 37 miles of Rome copper control cables, and 12 miles of Rome aluminum power cables are among the products being used at Pittsburg plant.

One of the junction boxes at the Pittsburg plant, showing terminals of cables to busses.

It Costs Less to Buy the Best

ROME CABLE Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

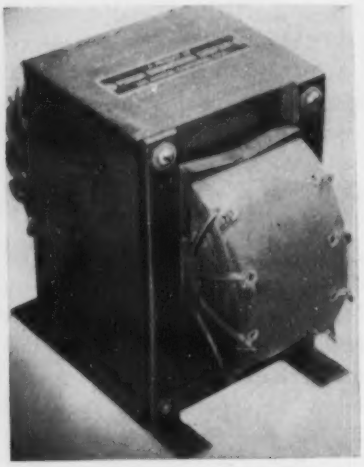

Whatever Your Method...
Reliable SERVICE ENTRANCE EQUIPMENT will serve you best
FLIP-ON TAP CLAMPS: Except for true bi-metal spacers, where used for copper run to aluminum tap, this 1:1 pressure ratio clamp is all aluminum. The design has an enviable record nearly 20 years long. A request for a sample Catalog No. 438 CUG (copper run to aluminum tap) may bring you something you've been looking for.
SPLIT BOLT CONNECTORS: Reliable's cataloging on Split Bolts affords the widest choice of types and combinations of accessories. All are of highest quality, strength and precision.
SERVICE ENTRANCE CONNECTORS: Extruded aluminum body, slotted aluminum screw and two true bi-metal spacers make a technically correct Service Entrance type connector for aluminum to copper. Bodies are cadmium plated.
COMPRESSION SLEEVES: Sleeves of aluminum are available with tin-plated copper inserts where compression tool aluminum-to-copper service connections are required.
Reliable offers a wide choice of aluminum-to-copper connectors that are predominantly aluminum.
Flip-on Tap Clamp
Split Bolt Connector
Service Entrance Connector
Compression Sleeve
Reliable
ELECTRIC COMPANY
3145 Carroll Avenue
Chicago 12, Illinois
Over 45 years of service to the utilities
POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

New Equipment

(*Continued from page* 214)

clutch is locked, preventing accidental dropping of load. Tirfor Griphoist operates in any position. Standard ½-in.-diam wire-rope travels continuously through machine, allowing any length to be used.

Princeton Griphoist, Inc, 32 George St, Boston 19, Mass.; Griphoist, Inc, 544 Market St, San Francisco 4, Calif.; or Secalt S. A., 19 Rue De Nassau, Luxembourg, Luxembourg



Dry Transformers

Open, dry-type power transformers are rated ½ to 100 kva, single- or 3-phase. Transformers are designed for industrial applications, such as power supply units, utility service, etc, and meet AIEE, NEMA, and ASA specifications.

Perkin Engineering Corp, 345 Kansas St, El Segundo, Calif.

Enclosed Motors

Totally-enclosed, fan-cooled constant-normal-speed motors have frame sizes 182 and 184. These Klosd-Tite motors conform to new NEMA standards.

Heavy-duty, double-shielded, prelubricated bearings have extra grease reservoir. Diagonal cover-type terminal boxes are tapped for conduit and may be rotated 360 deg and fixed in any position.

Sterling Electric Motors, Inc, 5401 Telegraph Rd, Los Angeles 22, Calif.

Taconite Motor

Totally-enclosed motor for taconite duty has shaft seals with extra-long sleeves of close tolerance. Seals are brass to bronze, two dissimilar and non-magnetic metals. End brackets are compound sealed. A filtered breathing vent is provided, relieving bearings of air pressure.

U. S. Electrical Motors Inc, Box 2058, Los Angeles 54, Calif.

Recording Controllers

A line of process instruments are designed for continuous measurement and control. Models are either potentiometric or ac bridge type, and have either electric or pneumatic control. Centerless pointer leaves chart visible and makes chart changing easy.

Potentiometric model uses a magnetic standard, eliminating dry cells and slidewires. Chart speeds are 1, 4, 8, 12, and 24 hr and 7 days. Models weigh 75-95 lb. Input is 120 v, 60 cps, 40-65 w.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.

Dielectric Test Set

Portable field instrument measures dc current at voltages up to 40 kv when applied to insulation of generators, transformers, bushings, cable, etc. Short-circuit current is 25 milliamp. Measurements can be made down to 0.5 microamp, the first division on meter. Dimensions are 19½

Whichever Way You Hang Your Drops...
Service Wedge Clamp
Straight-thru Deadend with Flexible Bail
Compression Deadend with Stainless Bail
Tie Strap
Reliable HAS THE RIGHT EQUIPMENT
ALUMINUM SERVICE WEDGE CLAMP: Available for either aluminum or copper with stainless steel bails or flexible bronze bails. Does not require feeding through clamp, may be attached to bare neutral of formed 3-wire drop at any point in span. Saves drop wire by permitting cut to exact length. Made in two sizes covering conductor range from 1/0 ACSR to No. 6 solid.
STRAIGHT-THRU AUTOMATIC DEADENDS: For copper and for aluminum with any type bail or clevis. Easily hung on hooks, spools or knobs. Permits easy adjustment of slack. Develops approximately full strength of conductor.
ALUMINUM COMPRESSION DEADEND: for aluminum only. Internally impregnated with a dispersion of fine, sharp silicon carbide particles to insure holding power. Provided with stainless steel bail having one leg detachable for use with spools or knobs. For service installations where compression tool joint is preferred. A compression deadend for banking transformers.
ALUMINUM TIE STRAPS: A simple method for tieing two insulated lines to the supporting bare neutral of formed 3-wire drop. High efficiency at low cost. Reliable equipment answers the problems in hanging drops for there is a unit to do efficiently any job in a manner that conforms to your practice.
Reliable ELECTRIC COMPANY
3145 Carroll Avenue
Chicago 12, Illinois
Over 45 years of service to the utilities
POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

HERE'S THE *NEW*
HUBBELL
Topper
AC
alternating current
Switch
TOPS IN QUALITY
TOPS IN PERFORMANCE

15 amperes, 120-277 volts

Meets the need for a quiet, yet dependable, long-life AC switch to withstand the inductive load characteristics of fluorescent lighting systems.

QUIET operation

OUTSTANDING FEATURES

- Meets and exceeds UL requirements
- Quiet operation (without mercury)
- Silver alloy contacts prevent corrosion
- Operates in any position
- Totally enclosed
- Designed for long life on full rated loads
- Back and side wiring utility
- "Upset" screws cannot come out
- Convenient strip gage
- Easy-to-find back wiring entry hole

Here it is . . . the newest addition to Hubbell's family of highest grade heavy-duty wiring devices. Quality designed for long-life dependability, the action is effortless and practically noiseless . . . the ideal answer for hospitals, nurseries, conference rooms, libraries, churches, bedrooms or other areas where quiet is essential to health and efficiency.

Write for the complete story today. Switch to Hubbell for quality.

See Your Electrical Distributor.

Highest Grade
HEAVY DUTY
WIRING HUBBELL DEVICES

HARVEY HUBBELL, Inc.
DEPT. E-2
BRIDGEPORT, CONNECTICUT

19HH84

x 13½ x 20 in.; weight is 120 lb. Hand truck for mounting is available. **James G. Biddle Co, 1316 Arch St, Philadelphia 7, Pa.**

Alpha Detector

Scintillation-type device, usable with most scalers and rate meters, detects alpha contamination on clothing and laboratory areas. Device has 150-sq-cm phosphor screen and an electron-multiplier phototube to produce an electrical pulse. Unit is insensitive to beta and gamma radiation and weighs 2 lb 6 oz. **General Electric Co, 1 River Rd, Schenectady 5, N. Y.**

Coming New Equipment

Received Too Late for This Issue

Rural Regulator

Line Material Co—With four 2.5% steps, for 15 and 25 amp, single phase

Hydraulic Derrick

McCabe-Powers Auto Body Co—Has live-boom derrick, handles 75-ft poles

Level Control

Level Control, Type 13DJ3, controls level of all electrically-conductive liquids having resistivity up to 20 megohms per cu cm. Control consists of electron-tube amplifier and relay, operating on 6 milliamp or less in the 11.5-v probe circuit. Stainless-steel probe rods contact liquid. Relay contacts are double-pole, double-throw. Single-break, non-inductive ac rating is 10 amp, 115-v; 5 amp, 230 v. Double-break rating is 20 amp, 115 v; 10 amp, 230 v. Input is 6 w, 115/230 v, 50-60 cps. **Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass.**

Infrared Tunnels

Air-flow drying tunnel kits are for screen-process drying. Variable-speed transmission gives belt speeds from

Roeplastic control cable—

THE ONLY CONTROL CABLE WITH CIRCUITS *POSITIVELY* IDENTIFIED

THIS NEW Roebling ROEPLASTIC Control Cable makes circuit identification quick and certain for the first time in history. A workman can't go wrong even if he's color blind. Here's why:

In ROEPLASTIC Control Cable, each conductor is identified from end to end by both its IPCEA code color name and its individual number by means of an indelible printing against a strongly contrasting background. The printing is permanent; it cannot fade or rub off... identification is always positive whether plans show circuits by color code or by numerals.

Roebling ROEPLASTIC Control and Signal Cables are ideal for such purposes as remote control of motors, switch gear, automatic machinery, etc.... for traffic light control, relay, metering and supervisory circuits. They are made in constructions, types of insulations and over-all sheaths to meet every specific requirement. Write for technical data... and order ROEPLASTIC Control and Signal Cables from your Roebling distributor. John A. Roebling's Sons Corporation, Trenton 2, N. J.

Subsidiary of The Colorado Fuel and Iron Corporation

ROEBLING

ATLANTA, 924 AVON AVE • BOSTON, 51 SLEEPER ST & 5 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST • DETROIT, 915 FISHER BLDG • HOUSTON, 6216 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1920 E. 2ND ST • PHILADELPHIA, 230 VINE ST • PITTSBURGH, ROOM 329, HENRY W. OLIVER BUILDING • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 321 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, N. J.

CF&I

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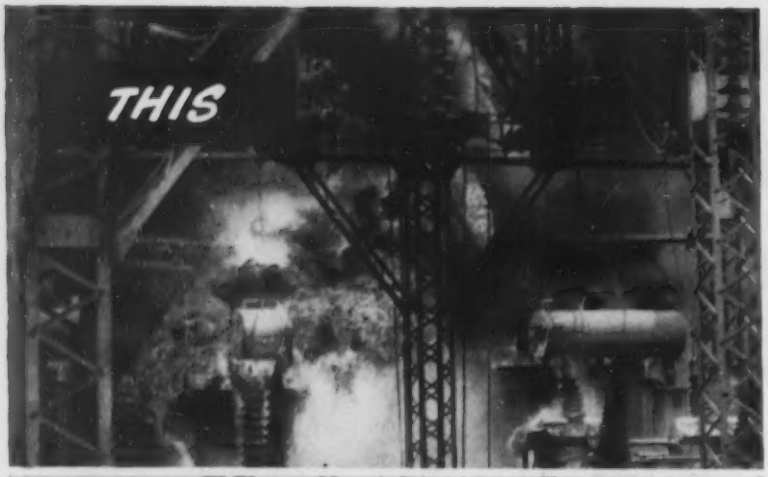
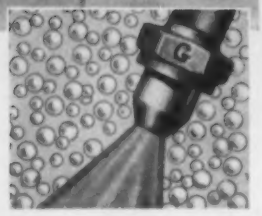




To protect your equipment, install safe, fast-acting GRINNELL MULSIFYRE

All it ever takes, at any time, is for an arc to come in contact with oil to touch off a fire. If unchecked, as with the $50,000 blaze in the top picture, damage can be extensive.

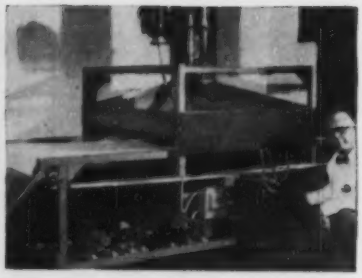
But if there are spray projectors of a Grinnell Mulsifyre System on guard, such as those being demonstrated in the lower photograph, extinguishment usually can be obtained in a matter of seconds. In fact, the record is replete with cases of fires, occurring in oil, which fast-acting Grinnell Mulsifyre Systems have put out in quick time.

A Grinnell Mulsifyre Systems is effective wherever the danger of fire in medium or heavy oils can be limited to a definite area. In these oils the surface emulsion remains to give after-protection against flashback.

There are hundreds of dependable Mulsifyre installations in service all over the world. Get the facts on how you can save trouble and expense with a reliable Grinnell emulsion-forming spray system. Write Grinnell Company, Inc., 252 West Exchange Street, Providence, Rhode Island. Branch offices in principal cities.

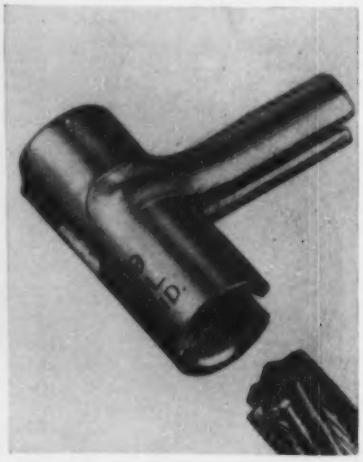
GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES



5.6 to 23.4 fpm. Intensity of heaters can be varied from 4 to 100% of capacity. Model with 46-in. hood length and 84-in. belt centers uses 3 heaters rated 2.5 kw each. Model with 70-in. hood and 108-in. belt length uses 6 heaters.

Edwin L. Wiegand Co, 7513 Thomas Blvd, Pittsburgh 8, Pa.



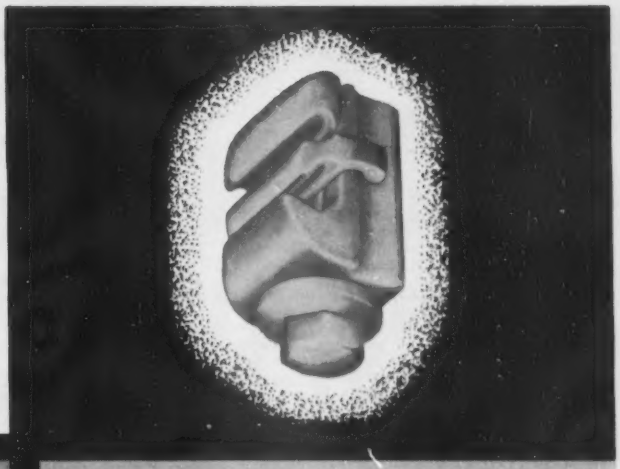
Al-Cable Adapter

Tin-plated, copper-alloy adapter designed for connecting No. 4 and 2 stranded aluminum cable to switch and control equipment is made in straight and right-angle types. Adapter is said to compensate for galvanic corrosion and difference in thermal expansion of dissimilar metals and combines good electrical conductivity with springiness.

Adapter consists of a split barrel to fit on cable and a split-cylinder tang for insertion under the equipment clamp. This design maintains spring pressure on circumference of conductor. Bore of barrel, slightly smaller, than cable, is serrated to break through oxide film. A factory-applied oxide-inhibiting compound seals joint.

Thomas & Betts Co, 36 Butler St, Elizabeth 1, N. Y.

A New FARGO Service Connector



Aluminum to Copper

Aluminum to Aluminum

FARGO'S PLATED* ALUMINUM SERVICE CONNECTOR for "All-Purpose" use

Fargo announces a new, plated, aluminum bodied Service Connector for "all-purpose" use. New design features were incorporated in this connector in keeping with the latest advances in aluminum connector research.

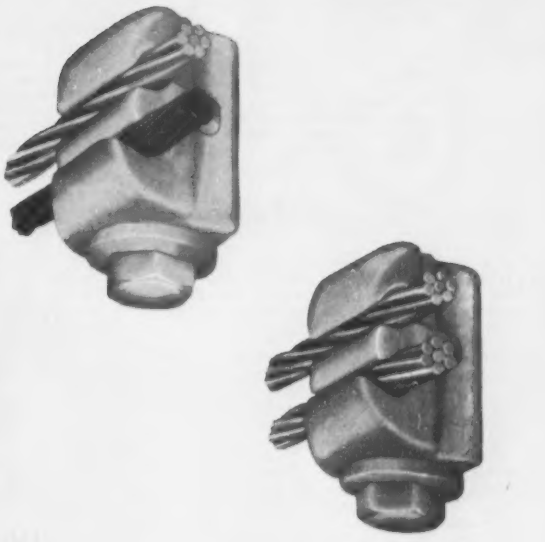
The connectors are made with quality controlled aluminum castings having excellent current carrying capacity. The service connector is chemically cleaned and rapidly handled while wet in the plating process so that the inherent high contact resistance of aluminum is eliminated and replaced with the low contact resistance of the plated surface. The plating of the connector also makes it unnecessary to clean the jaws before installation in the field and allows copper conductors to be used in either groove.

The Service Connector is massive with wide jaws for large areas of contact, minimizing distortion and cold flow of the aluminum conductor. Each conductor strand is brought under a pressure area, giving an even distribution of current through the conductor at the joint. More than adequate conductor separation is obtained with a soft, thick aluminum spacer pad which forms around the strands, reducing galvanic corrosion on transfer surfaces. Larger comparative mass and greater radiating surfaces of the connector results in better heat dissipation under normal and fault currents.

Fargo's "one-piece" plated aluminum Service Connectors have a wide range from a minimum of two #8 sol. to a maximum of two #4 ACSR or any combination within these sizes. One connector replaces several sizes formerly necessary.

Other Fargo plated aluminum connectors are available up to 397,500 ACSR.

*Standard plating is tin - zinc alloy.



Patented

Ask your Line Material Field Engineer for complete details.

FARGO

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N. Y.

Distributed by
LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin

LM®

CATALOGS AND BULLETINS

● **DUAL-FUEL ENGINES:** Bulletin S-500-B57, 36 pages, shows typical installations of duel-fuel engines. Worthington Corp, Harrison, N. J.

● **DYNAMOMETERS:** Bulletin 154, 4 pages, lists two dynamometers. Model DM-3 measures up to 2 hp; Model MDM, up to 1/10 hp. Mission-Western Engineers, Inc, 132 W. Colorado, Pasadena 1, Calif.

● **EMERGENCY LIGHTING:** Folder describes Light Warden Chargomatic 88 emergency lighting equipment which uses 105-amp-hr battery and operates automatically on supply failure. Electric Cord Co, 197 William St, New York 38, N. Y.

● **COMPUTERS:** "Light on the Future," 30-page booklet, gives principles of electronic data processing equipment, analog and digital computers. It describes functions of input, storage, arithmetic, control, and output components. Glossary. International Business Machines Corp, 590 Madison Ave, New York 22, N. Y.

● **FURNACE CONTROLLERS:** Bulletin P1262, catalog sheet, lists stock furnace and oven control instruments, including indicating pyrometers and controllers, indicating thermometer controllers, traveling oven recording thermometer, and Pyrotrol combustion safeguards. Bristol Co, Waterbury 20, Conn.

● **TRANSFORMERS:** Bulletin S-302A, 4 pages, lists OISC distribution transformers with built-in surge and overload protection, in ratings up to 100 kva and 14,400 v. Bulletin S-301B, 8 pages, lists single high-voltage bushing rural transformers in ratings up to 25 kva and 14,400 volts. Standard Transformer Co, 140 Dana St, N. E., Warren, Ohio.

● **AUTOMATIC SPRINKLER:** Bulletin 2426, 8 pages, describes types of automatic fire protection systems—water, fog, foam, and carbon dioxide. Biaw-Knox Co, 829 Beaver Ave, Pittsburgh 33, Pa.

● **CONDENSER TUBES:** Bulletin TB-329A, 6 pages, lists analyses and mechanical properties of 29 carbon, alloy, and stainless tubing steels used in heat exchangers and condensers. Babcock & Wilcox Co, 712 11th St, Beaver Falls, Pa.

● **LAMP STARTERS:** Form 1-159, 4 pages, covers pushbutton and automatic reset fluorescent lamp starters. Lustra Corporation of America, 36 Washington St, Brooklyn 1, N. Y.

● **PROTECTIVE PAINTS:** Form 253, 20-page general catalog, covers rust preventives and gives instructions for surface preparation and application. Includes 94 color chips. Rust-Oleum Corp, 2799 Oakton St, Evanston, Ill.

● **SMALL SWITCHES:** Ultra-small Type V3 snap-action Microswitches of 15 types are shown in Catalog 74, 4 pages. Minneapolis-Honeywell Regulator Co, Freeport, Ill.

● **PORTABLE BAND SAW:** Form A984, 4 pages, describes Model 524 portable electric band saw and accessories. Porter-Cable Machine Co, 1714 N. Salina St, Syracuse 8, N. Y.

● **INSTRUMENT CHECKER:** Bulletin A14, 1 page, gives specifications and uses for Lin-A-Chek, an instrument for checking linearity of voltmeters, milliammeters, galvanometers, etc. Micrometrical Development Corp, 2821 S. State St, Ann Arbor, Mich.

● **RUBBER PARTS AND TUBING:** Two catalogs cover molded and extruded rubber parts and tubing. "Standard Rubber Parts from Stock Molds," Catalog M77, lists 20 pages of grommets, bumpers, suction cups bushings, O-rings, gaskets, etc. Tubing Catalog M100 lists 18 pages of pure gum, neoprene, Buna, Latex rubber and plastic tubing. Miller Products Co, Inc, 29 Warren St, New York 7, N. Y.

● **CORDS:** Wire cordage and cord sets are illustrated with drawings and ratings in 30-page catalog. Essex Wire Corp, 121 Dodge Ave, DeKalb, Ill.

● **INTERIOR LIGHTING:** Bulletin A, 8 pages, covers recommended illuminating levels and procedure for selecting light source. Pittsburgh Reflector Co, 408 Oliver Bldg, Pittsburgh 22, Pa.

● **INDUSTRIAL EQUIPMENT:** Bulletin WP-1099-B61, 16 pages, covers applications, special features, types, sizes and capacities of various product lines of industrial equipment. Worthington Corp, Harrison, N. J.

● **RAILROAD-TRACK SCALES:** A 14-page catalog, Form 685, gives specifications on 25 standard models of heavy-duty, four-section, straight-lever, railroad-track scales. Capacities range from 60 to 200 tons per section. Howe Scale Co, Rutland, Vt.

● **LAMINATED PLASTICS:** Bulletin 80-2, 16 pages, has data on manufacture, grades, properties, fabrication, and use of laminated plastic sheets, tubes, rods, and special shapes. Also covers decorative plastic sheets and plastic bearings. Joseph T. Ryerson & Son, Inc, P. O. Box 8000-A, Chicago 80, Ill.

● **CLOSING DEVICE FOR CIRCUIT BREAKERS:** Bulletin 71B8105, 4 pages, describes Pneu-Draulic emergency closing device for standard air magnetic circuit breakers in metal-clad switchgear. Device insures adequate closing speed during loss of control power. Adaptable for 13.8 or 4.16-kv circuit breakers, device weighs 40 lb, measures 8 x 4 x 10 in. Allis-Chalmers Manufacturing Co, 932 S. 70th St, Milwaukee, Wis.

● **MICROWAVE SYSTEMS:** Form MW-953, "Electric Utility Microwave Systems," 36 pages, describes microwave systems used for voice, teletypewriter, facsimile, telemetering, load control, etc. Radio Corporation of America, Building 15-1, Camden 2, N. J.

● **VALVES:** Form RS111, Sec. C, 6 pages, gives applications, construction details, and dimensions for 4 types of Model 73 solenoid valve. Form W-2-S, Sec. M, 12 pages, gives specifications, charts, how-to-select and sales data for valves, filters, and driers for air conditioning and refrigeration. A-P Controls Corp, 2450 N. 32nd St, Milwaukee, Wis.

● **INSTRUMENTS:** Catalog 54, 190 pages, lists electrical meters, industrial controls, test equipment, pyrometers, thermometers, timers, relays, components, etc. Products of about 100 manufacturers are listed. Electro-Tech Equipment Co, 298 Canal St, New York 13, N. Y.

● **VALVES:** Bulletin 1701, 12 pages, gives specifications of air-operated butterfly valves and Series 800 diaphragm motor operators. Minneapolis-Honeywell Regulator Co, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **BATTERY UNIT:** Catalog (sheet) 514 describes 24 and 48-v battery units in cabinets for tripping circuit breakers. Primary input is 115 or 230 v ac. Pacific Electric Manufacturing Corp, 5815 Third St, San Francisco 24, Calif.

● **ALUMINUM:** Research and Progress In Electrical Conductors, 20 pages, tells story of aluminum conductors. Aluminum Co of America, 1501 Alcoa Bldg, Pittsburgh 19, Pa.

● **RHEOSTAT:** Bulletin 1116, catalog sheet, describes 300-w Vitrom ring-type rheostats, made in sizes 1.0 to 2,500 ohms. Ward Leonard Electric Co, Mt. Vernon, N. Y.

● **SCREWS:** Catalog 50, 36 pages, covers machine screws. Mac-It Parts Co, Lancaster, Pa.

● **AIR PREHEATER:** "Lungstrom Air Preheater," 36 pages, describes regenerative gas-to-gas heat transfer, as used to preheat boiler air from waste heat in flue gases. Air Preheater Corp, 60 E. 42nd St, New York 17, N. Y.

● **SOLENOID VALVES:** Bulletin 500A, 4 pages, covers specifications, applications, operation, design, and construction of 25 types of solenoid valves, from ¼ to 3 in. J. D. Gould Co, 730 E. Washington St, Indianapolis 2, Ind.

● **SELENIUM RECTIFIERS:** Bulletin 178, 6 pages, covers cartridge-type selenium rectifiers. Ratings extend to 8,000 peak inverse volts. Radio Receptor Co, Inc, 251 W. 19th St, New York 11, N. Y.

● **GE BULLETINS:** Following are available from General Electric Co, 1 River Rd, Schenectady 5, N. Y.:

GEA-1816H Open Drop-out Fuse Cutouts—16 pages. Ratings are 7.8 and 15.0 kv, 100 amp.

GEA-5095A Heating Pipelines with Electric Heaters—8 pages.

GEA-5887 Rubber and Plastics Mill Drives—4 pages.

GEA-5983 Forging with Induction Heat—8 pages.

GED-1982 Movable-Bridge Electrification—12 pages.

● **GAS ANALYZERS:** A 4-page bulletin covers Portoco carbon monoxide detector. Detector is 15 x 15 x 12 in., weighs 100 lb., measures 0 to 10 parts CO per 10,000. Bulletin 301, 4 pages, covers hydrogen analyzer. Analyzer records H_2 content, weighs 750 lb. Taller & Cooper, 76 Front St, Broklyn 1, N. Y.

● **TACHOMETER:** Bulletin 1153, 16 pages, describes electric tachometer, its generator, generator drive, connections to instruments, and recorder. Esterline-Angus Co, Inc, P O Box 596, Indianapolis 6, Ind.

● **MOTOR GUIDE:** Compar-A-Frame chart compares old and new NEMA open-type and fan-cooled polyphase induction motors. Reliance Electric & Engineering Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio.

● **BUILDING WIRE:** Catalog, 32 pages, of wire for residential, commercial, and industrial use has NEC tables. Triangle Conduit & Cable Co, Inc, Triangle and Jersey Ave, New Brunswick, N. J.

● **CAPACITORS:** Catalog AC-4, 48 pages, covers electrolytic, paper-foil, and metallized-paper capacitors. Astron Corp, 255 Grant Ave, E. Newark, N. J.

● **CABLE PULLER:** Four-page folder covers powered cable puller, rated 15 fpm at 1200 lb, 115 v, for conduit wiring. Barth Corp, 12650 Brookpark Rd, Cleveland 29, Ohio

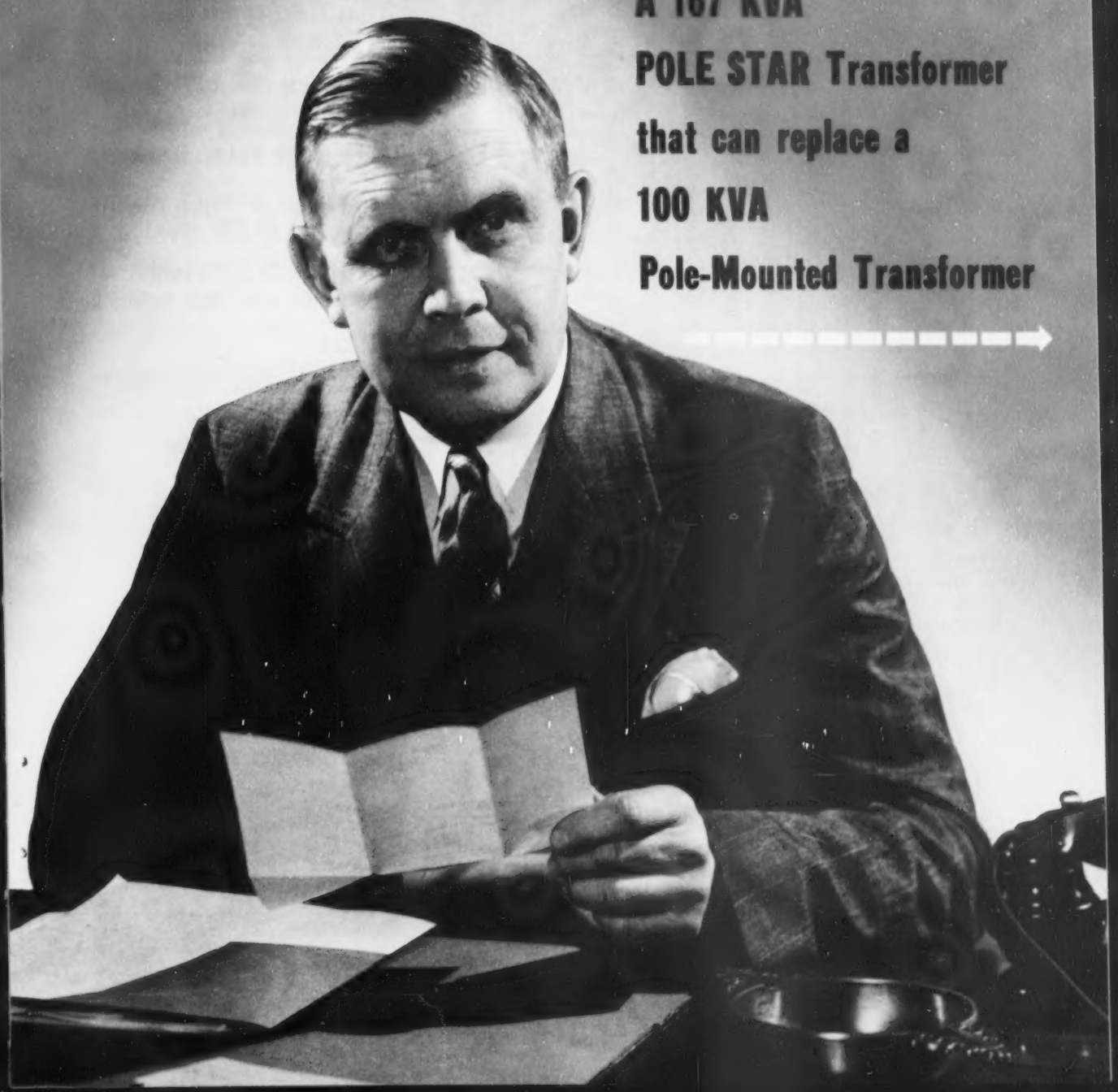
● **VALVES:** Catalog 12-D1, 18 pages, covers blow-off valves rated 300 through 2,500 lb sp. Edward Valves, Inc, 1211 W. 145th St, East Chicago, Ind.

● **RESISTORS:** Form 79-8, 28-page catalog, covers fixed and adjustable wire-wound resistors and power rheostats. P. R. Mallory & Co, Inc, Frankfort, Indiana

● **WOVEN HEATERS:** Folder F-1548, 4 pages, describes woven electric heaters. Pre-Fab Heater Co, Guilford, Conn.

YOU asked for it!

A 167 KVA
POLE STAR Transformer
that can replace a
100 KVA
Pole-Mounted Transformer



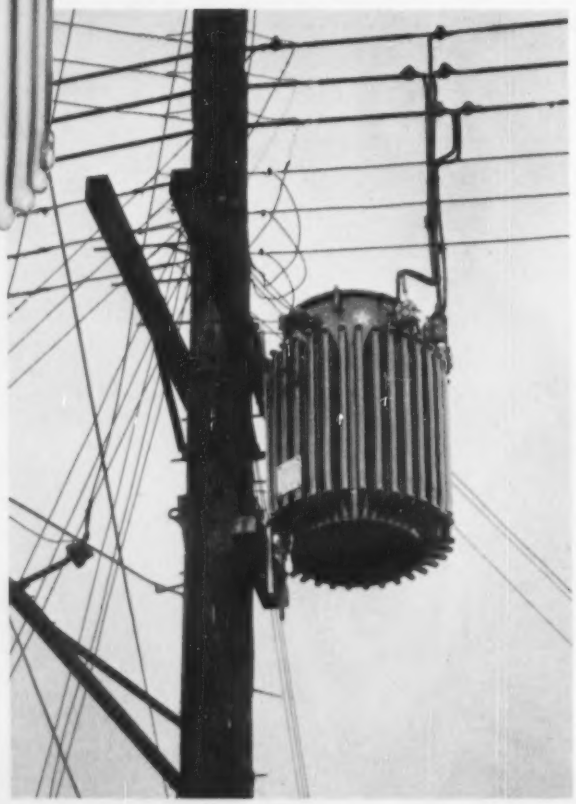
Pennsylvania Transformer Company

Introduces the New 167 KVA *Featherweight*.....

- ★ **Will replace any single phase 75 or 100 Kva Pole-mounted Transformer to provide 67% to 123% more capacity**
- ★ **Weighs less than 1500 pounds**
- ★ **Lower in overall height than average 100 Kva transformer**
- ★ **Available in standard voltages up through 13,200 volts**
- ★ **The FIRST 167 Kva transformer made for direct pole mounting**

AVOID THESE AND OTHER EXPENSIVE ALTERNATE MEASURES BY INSTALLING 167 KVA FEATHERWEIGHT POLE STARS

1. **Heavier poles** (if permitted by local ordinances) which would be required in order to carry heavier transformers.
2. **Double poles** for platform mounting of transformers.
3. **Underground systems** which involve expensive subway or vault-type installations.



167 Kva Featherweight Pole Star installed to relieve power shortage in congested business neighborhood. New "featherweight" transformer replaced 100 Kva unit to provide ⅔ additional capacity.

....POLE STAR TRANSFORMER

Utility Engineers asked for this Transformer

The continuing increased demand for more power is presenting a problem to utility companies serving crowded urban areas. Many power companies with distribution lines located in congested neighborhoods prefer to supply this load through larger-rated pole-mounted transformers rather than resort to more expensive measures, such as underground installations, additional poles for platform mounting, etc.

However, many utility poles in use today are designed to carry a *maximum* of 1500 pounds of transformers. The average weight of all present-day 100 Kva cold-rolled steel transformers — and yesterday's 75 Kva hot-rolled steel transformers — is approximately 1450 pounds. Therefore, 100 Kva is the largest pole-mounted transformer that these poles can carry.

Pennsylvania engineers were advised of this problem and were asked to design a 167 Kva transformer (*the next standard size after 100 Kva*) that weighs less than 1500 pounds. *And that's what Pennsylvania did!* Its answer to this problem is the new 167 Kva featherweight Pole Star.

Mechanical Characteristics

Weighs less than 1500 pounds.

Conforms to EEI-NEMA Fifth Report except for additional brackets for direct pole mounting.

Overall floor space slightly larger than average for 100 Kva transformers.

Overall height approximately 8″ less than industry average for 100 Kva transformers.

Electrical Characteristics

Regulation — Regulation in the new 167 Kva featherweight design compares favorably with that of the regular 167 Kva Pole Star.

Losses — The "featherweight" Pole Star is more efficient up to 60% loading and slightly less efficient above 60% loading.

Exciting Current — Low exciting current found in all Pole Star designs are also inherent in the 167 Kva featherweight design.

For further information on Pennsylvania's new 167 Kva Featherweight Pole Star, write, phone or wire your nearest Pennsylvania Sales Representative, or contact

DISTRIBUTION SALES DEPARTMENT

PENNSYLVANIA TRANSFORMER COMPANY

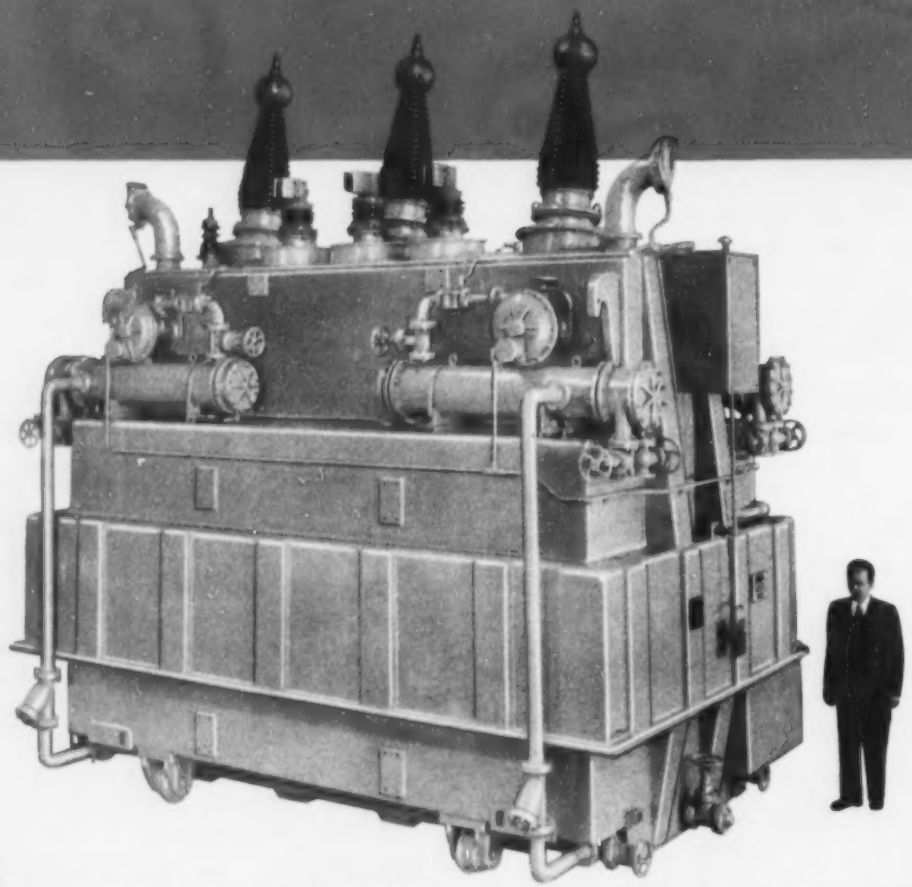
A McGraw Electric Company Division **Box 330 CANONSBURG, PENNSYLVANIA**

Phone: CANONSBURG 2380

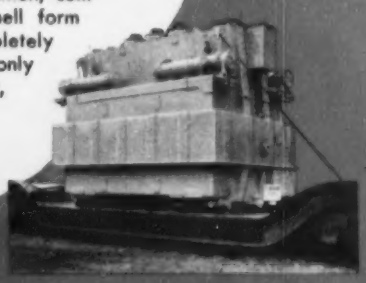
105,000 KVA

THREE PHASE • CONTOUR DESIGN

Pennsylvania Power Transformer



The function of this 105,000 Kva Pennsylvania Power transformer is to step up the generator voltage of 13,200 volts and transmit it at 115,000 volts . . . The transformer traveled by train to its destination in an upright position, completely assembled except for bushings. The space-saving shell form construction of the core and coils made this possible . . . Completely assembled and filled with oil, the transformer weighs only 252,000 pounds. Due to the Contour Design of the tank, less than 7000 gallons of oil were required . . . The transformer measures 172 inches to the top of the bushing casings and has an overall height of 231 inches.



PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PA. • *Greater Pittsburgh District*

LETTERS TO THE EDITOR

'There Must Be Research'

To the Editor:

The April 19 editorial, "Research by the Electric Utilities", points to a situation which is deserving of the attention of your readers.

Research categorically covers a multitude of efforts, has a reputation of being expensive, and is frequently misunderstood or ignored. Basic research, industrial research, product and application development whether so called or not have built great industries of which the utility is representative.

The cost of research, although present in many forms is absent per se in many accounting systems but is still a vital and necessary expense of the industry. Manufacturers supplying the utility trade have underwritten most of the cost and have defined and accepted the many forms of research that concern their products. Systems research, component comparisons, and efforts to establish the value of new improvements, however become an activity of an engineering or planning department whose engineering research efforts are likewise being pursued with much vigor and at considerable expense many times without the dignity or formality of their being considered "research." Whether basic or applied and whether masqueraded under other headings, there must be research and development cost associated with every worthwhile system addition. The research costs may not be apparent in any ordinary survey.

While we might question the value of recognizing this expense, the suggestion of pooling resources and of assigning both funds and responsibility to an enthusiastic organized group of experts is a good one. We are repeatedly confronted with examples of what can be accomplished by such cooperation. The Hobson-Lewis report's suggestions for a centralized or at least an organized research and engineering" service would undoubtedly pay dividends on a broad plane.

Prof. S. W. Zimmerman
In Charge, High Voltage
Research Laboratory
Cornell University
Ithaca, New York

Keeping Matters Straight

To the Editor:

On page 47 of the April 26 issue are two paragraphs quoted below:

"Higher Secondary Voltage . . . Utilities should give serious thought to possible benefits to them of higher secondary voltage in distribution systems of downtown commercial areas, said R. F. Lawrence, Westinghouse.

"The industry will not be able to make the complete changes to the 240/480 secondary voltages, said D. K. Blake, GE, declaring it just isn't in the cards."

Probably most of the readers will differentiate that each of these paragraphs refers to different parts of the distribution system. I felt it might be worthwhile to write this letter and point out that our discussion refers to commercial areas as mentioned while Mr Blake's comments on 240/480 secondary voltages refer to residential distribution.

I believe that this explanation will avoid misinterpretation by the casual reader who might be only mildly familiar with secondary distribution voltages.

Robert F. Lawrence
Distribution Engineer
Westinghouse Electric Corp.
East Pittsburgh, Pa.

No Expiration Date

To the Editor:

On page 59 of your issue of April 12 appears a brief comment under the title "Buy American Preferences Weakened by Ike's Policy." The last paragraph of this statement says that "the Buy American Act is scheduled to expire June 12 unless legislative action is taken."

When reading this passage I felt certain that this was an error or mixup in that June 12 is the expiration date of the Reciprocal Trade Agreement Act.

I have, however, since checked with Washington and would thus like to tell you definitely that the Buy American Act has no expiration date and could only be terminated or modified by affirmative legislative action.

The important thing is, of course, how far the various agencies of the executive branch of the government will follow and implement the policy stated by the president.

Paul R. Sidler
President

Brown Boveri
New York, N. Y.

Excuse, Please

To the Editor:

After he had seen my outstanding performance in the role of John Hunt, advertising manager, in the skit, "The Jubilee Meets the Press" at the recent EEI sales conference, a member of your staff told me he had heard that Hollywood was making me an offer. I sat up all that night, waiting, but nothing came from Hollywood; so I guess he must have been mistaken.

As much mistaken as the caption on page 108 of your Diamond Jubilee issue, April 5, which has me working for the Hartford Electric Light Co. Now my company, United Illuminating, is perfectly willing to let me take on extracurricular activities like the sales conference skit, but, quite naturally, it sort of likes to have credit for such indulgence.

Laurence A. Dunn
Merchandise Manager
United Illuminating Co
New Haven, Conn.

EEI Report Issue June 14

The June 14 issue of Electrical World will feature the annual meeting of Edison Electric Institute. There will be a complete report of the important speeches made at the June 1-3 sessions, stories on the other activities, and a presentation of the new president to the industry.

NEWS ABOUT PEOPLE

FISCHER S. BLACK

RALPH H. FLYNN

Black Made Publisher . . .

. . . of Electrical World to replace Ralph Flynn, who joins Popular Science. EW's top official to continue as editor

Fischer S. Black, editor of Electrical World, has been named publisher effective June 1, but he will continue as editor. He succeeds Ralph H. Flynn, who has resigned to become a vice president and treasurer of Popular Science Publishing Co July 1.

Black has filled the EW editorship since July 15, 1948. Before joining the magazine he spent 15 years in the operating electric utility field. He acquired his experience in the engineering, system planning, and executive departments of Potomac Electric Power Co and Nantahala Power & Light Co. His last utility post was that of assistant to the president of Pepco.

Engineer, Lawyer . . . The new publisher hails from Bryson City, N. C. He was graduated from the University of North Carolina in 1933 with a BS degree in electrical engineering. From 1936 to 1939, while employed by Pepco, he attended the National University Law School, where he received LLB and Master of Patent Law degrees. He also did graduate work in public utility law.

Among his most recent non-professional activities, Black is now serving as moderator of the "Better Living Television Theater," a half hour weekly film series appearing on the DuMont Television Network.

Flynn has been publisher of Electrical World since October, 1947. His career in the industry started when he joined Electrical West's editorial staff in 1930, after graduation from the University of Southern California. Subsequently he left to join the sales department of Pacific Gas & Electric Co, later becoming advertising manager of the then San Joaquin Power & Light Corp.

Flynn returned to Electrical West in 1935 as eastern manager, assuming the added duties of district manager of Electrical Merchandising and Electronics in 1937. He was named in April, 1947, as assistant publisher of Electrical World, becoming publisher in October of that year.

•

George Prendergast, attorney for Southwestern Gas & Electric Co for 30 years, has been named a member of the utility's board of directors.

Bernard E. Gallagher, for the past four years a staff assistant with Consolidated Edison Co of New York, Inc, has been named assistant to Pres H. R. Searing. Gallagher, who in 1930 joined New York & Queens Electric Light & Power Co, now part of Con Edison, succeeds **Edward E. Hill,** who has retired after serving 50 years with the Con Edison system. Hill served as assistant to Con Edison's president eight years, five during Searing's term as president and three when he served as executive vice president.

Fred M. Argue has been advanced from assistant engineering manager to engineering manager of Stone & Webster Engineering Corp, Boston.

Fred W. Bush, assistant manager in charge of the electrical sections of Allis-Chalmers Manufacturing Co's power department for the past three years, has been appointed assistant to the vice president in charge of transformer and switchgear equipment. The company also announced the assignment of **Raymond O. Bell,** special representative in the power department, to the transformer and switchgear organization to handle special assignments. **David A. Griffith,** assistant general manager at Pittsburgh for the last year, was made general manager of the Pittsburgh Works.

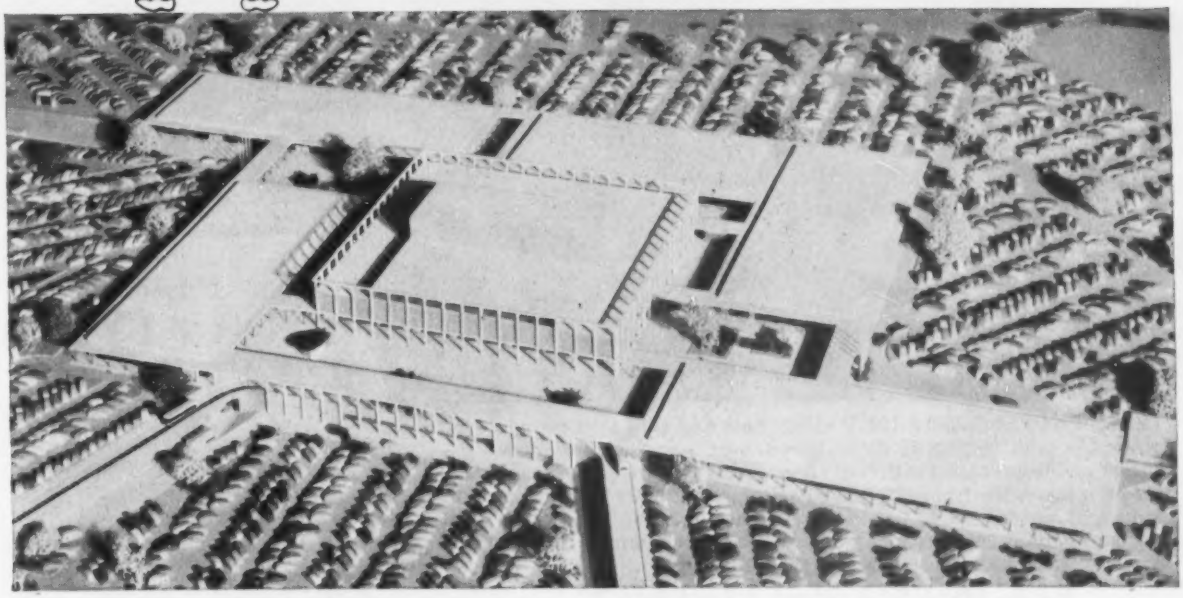
F. WARREN COOPER

Public Service E&G Names Cooper a Vice President

F. Warren Cooper, comptroller of Public Service Electric & Gas Co, Newark, N. J., has been elected vice president and comptroller.

Cooper started with Public Service in 1920 as an accountant. He became chief accountant in 1924, assistant general auditor in 1945, and assistant comptroller three years later. He was made comptroller in 1950.

As Distribution Expands–



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DO IT THE HARD, COSTLY WAY ...YOURSELF?

To do it yourself would mean your adding costly crews, experience may be lacking, expensive equipment would be necessary . . . and inexperience may lead to serious mishaps!

Utilities Line Construction service provides everything: skilled crews in the number required . . . latest tools and equipment . . . rigid safety standards . . . unexcelled public relations! Pin-pointed to *your* job!

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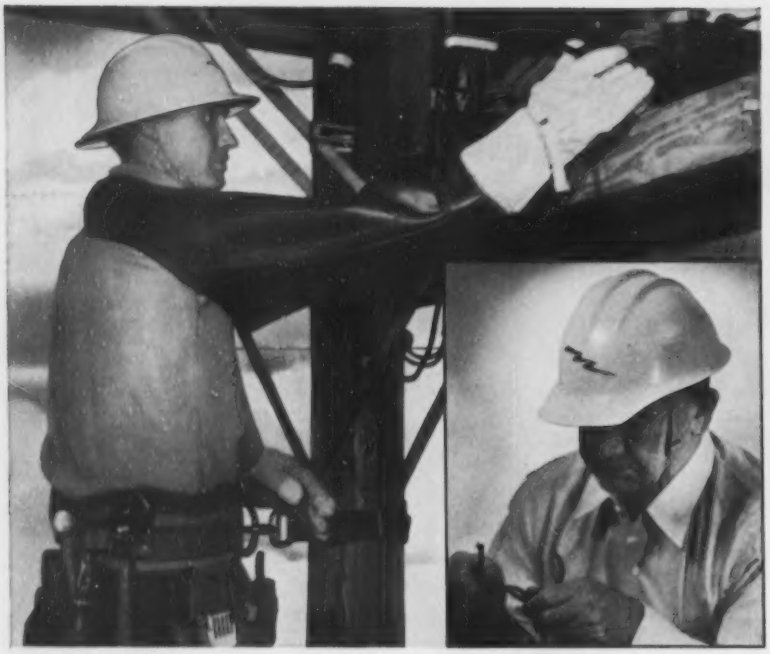
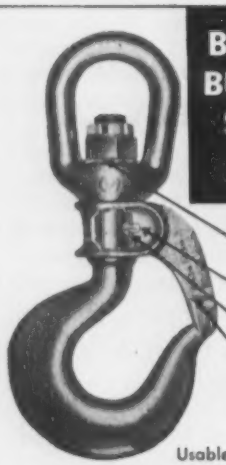


TESTS PROVE* Bullard 10KV safety hats and caps give complete head protection both from head blows from falling wrenches, insulators, "rake-sticks" and from contact with "hot" lines. Every Bullard hat and cap is tested before it leaves the factory to 10,000 volts . . . and every hat and cap passes industrial and federal 40 ft. pound resistance tests. No holes or rivets that might eventually cause leakage pass through crown or brim. Permanent colors available at no added cost. Universal headsize.

ELECTRICAL INDUSTRIES SLASH ACCIDENT COSTS!



BULLARD BURNHAM SAFETY HOOKS

Anti-friction bearing
Locking pin
Locking groove
Non-corrosive brass safety gate

Usable with every type of equipment (chain hoists, horizontal tuggers, come-a-longs, cranes, block and tackle, and snatch blocks). The B-B safety hook provides complete PROTECTION where accidents begin.

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Quick, effective oral immunization against poison oak and poison ivy. Write for the new Bullard first aid catalog.

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TESTED 10 000 VOLTS 10 Kv
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***FREE**—write for Multiphase laboratory report and circular on 10KV hats and caps. Brochure also available on Bullard-Burnham hooks.

RICHARD W. LEACH

Wisconsin Electric Power Appoints Leach a VP

Richard W. Leach, manager of the Western Division of Wisconsin Electric Power Co, has been elected vice president in charge of the utility's extension system. He replaces Stanley B. Sherman, who has retired.

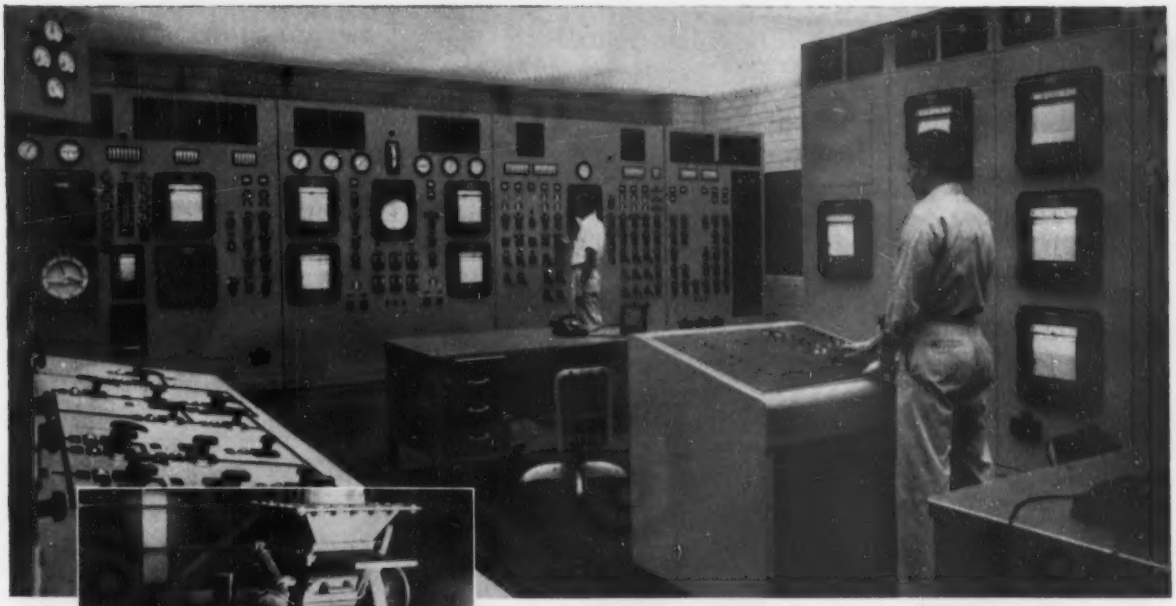
Leach's service with the utility began in 1920 when he started as a lineman's helper. In 1924 he left to enroll at the University of Wisconsin, earning an engineering degree four years later. After graduation he did electric distribution work at Racine, becoming manager at Waukesha in 1935. Three years later he was promoted to assistant manager of the Western Division, becoming manager in 1941.

Sherman's retirement ends a 35-year utility career. Before assuming the post of vice president, he served for a number of years as chief engineer. In addition to retiring from the electric utility posts, Sherman has retired as vice president and general manager of Wisconsin Natural Gas Co. Leach has also taken over these posts.

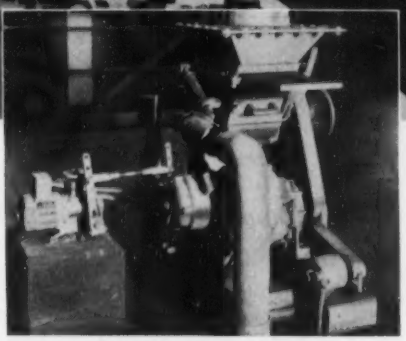
•

Forest Young has joined the executive organization of G&W Electric Specialty Co. Young, who until recently operated his own manufacturers agency in Los Angeles, was associated with Locke Insulator Division of General Electric after leaving Lapp Insulator Co, which he served as vice president and executive vice president.

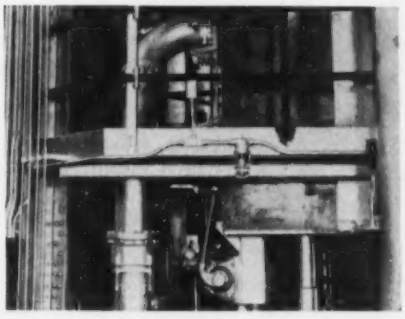
John Y. Lansing has joined the staff of Pacific Power & Light Co as an assistant vice president to work in the



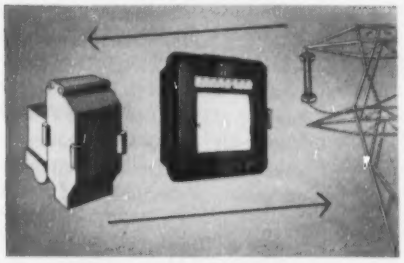
Load-frequency control & panel engineering



Combustion control



Superheat-reheat control



Combustion rate anticipator

In addition to control applications, L&N provides Speedomax® and Micromax® recorders for all power plant temperatures, conductivity, pH, per cent CO_2, O_2, steam purity, smoke, frequency, voltage and current (both AC & DC) power factor, kw, rkva, kva, daylight intensity and humidity.

YES, L&N DOES OFFER
THE COMPLETE

coal-to-kilowatt control system...

and you get more than merely undivided responsibility. You benefit dollar-wise from the precision engineering which goes into the design, development and application of every L&N control component. The Speedomax® recorders and controllers used, for example, are the same types of instruments preferred by research laboratories for extremely high precision and reliability.

And of equal importance, when you specify L&N control, you get the benefit of application experience based on the complete power plant problem. For in the past 25 years, L&N Field Engineers have tackled—and solved—instrument engineering problems in every phase of combustion, superheat-reheat, and load-frequency control.

So, if you're thinking in terms of complete, *integrated* control and savings in operating costs for the long haul, look to L&N. Offices in 18 major cities, or 4938 Stenton Ave., Phila. 44, Pa.

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instruments *automatic controls • furnace*

Easily...Economically with Subalox

Subalox is a complete paint system, so easy and economical to use that a single coat gives an excellent and lasting job. Can be applied by customary methods, but for most satisfactory application we recommend floor brooms.

Subalox is based on a heavy collodial lead pigment which gives excellent rust protection and limits spattering when applied to wire mesh.

Subalox is available in a variety of colors—the most popular being the metallics used to simulate the appearance of galvanizing. Old fences can be given a "new look" which can be easily maintained with a minimum of time, labor and material cost.

Detailed instructions are contained in "SIMPLIFIED FENCE PAINTING"—yours for the asking.

Subox Inc.

3 Fairmount Plant, Hackensack, N. J.

field of public relations. For the past seven years Lansing has served as assistant to the manager of Columbia Empire Industries, Inc.

WILLIAM T. RICHARDS

Indianapolis P&L Elects Richards VP of Sales

William T. Richards, assistant vice president of Indianapolis Power & Light Co, has been elected vice president in charge of sales.

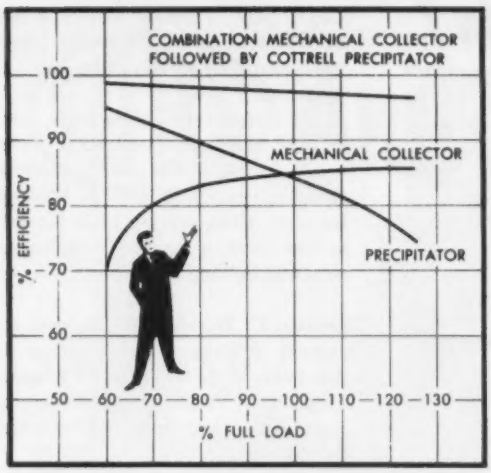
With Indianapolis P&L since 1926, Richards was made director of power sales in 1941, assistant sales manager in 1946, commercial manager in 1952, and assistant vice president last year. Besides being active in committee work of Edison Electric Institute and Indiana Electric Association, he is a director of the Electric League of Indianapolis, Inc.

•

Michael J. Kraemer, formerly a public utilities economist for Lionel D. Edie & Co, Inc, has joined Commonwealth Services, Inc, New York, as a general consultant. Kraemer, who became affiliated with the Edie organization in 1948, will specialize in financial studies, security analyses, and budgetary projections and forecasts.

Ernest L. Barth, secretary and treasurer of Metropolitan Edison Co, has been elected a director of the utility.

J. Burch McMorran has been named chief engineer of the New York State Power Authority with offices in New York. Just recently he resigned as chief engineer of the New York State



Advantages of the Western Precipitation CMP Unit

for recovering solids from stack gases in public utility operations

The control and recovery of fly ash from stack gases has always been a troublesome problem in public utility operations. With the development of the CMP unit by Western Precipitation Corporation, new economy and efficiency in the solution of fly ash problems are now possible.

Almost a half century ago Western Precipitation pioneered the first commercial application of the now-famous Cottrell Electrical Precipitator to recover suspensions *electrically*, and this equipment is still unsurpassed in its field.

Subsequently, to provide efficient fly ash recovery for low cost installations, Western Precipitation also pioneered the first small tube *mechanical* recovery unit — the Multiclone Collector — and this unit promptly gained widespread recognition for the new efficiencies it brought to mechanical recovery processes.

Combination Multiclone-Precipitator Unit. From these years of experience gained in both Cottrell and Multiclone installations, Western Precipitation recently offered another new development — the CMP Unit — a unit that combines in one compact installation many of the best features of both electrical and mechanical recovery methods.

In a typical CMP Unit, the stack gases first pass through a Multiclone section where the heavier materials are removed *mechanically*.

The partially-cleaned gases then pass through a Cottrell section where the very small particles are removed *electrically*.

This arrangement offers several advantages important to public utilities. Removing the heavier particles by the Multiclone process permits the bulk of the recovery operation to be performed with relatively low-cost equipment. Using a Cottrell for the final clean-up insures unusually high recovery efficiency — approaching theoretically perfect, if desired. Thus, the CMP combines high recovery efficiency with low total cost . . . and, as shown in the chart above, has the further advantage that the efficiency curve of the Multiclone portion complements that of the Cottrell portion — *therefore the overall CMP efficiency remains practically uniform at all boiler loads.*

> At low boiler loads the recovery efficiency of the Cottrell is highest, while that of the Multiclone reaches its maximum at high boiler loads. But, by combining the two types of equipment into a *single* CMP unit, the efficiency curve remains almost flat whether the boiler load is low or high.

With CMP equipment, even small utility companies can now afford adequate fly ash recovery. However, it is important to remember that full benefit of the CMP principle can be obtained only by a proper balance between the mechanical and electrical sections to fit the individual requirements of *each individual* installation. And no organization is better equipped to provide this critical "know-how" than the organization that provides integrated responsibility for Cottrell, Multiclone and CMP methods . . . *the Western Precipitation Corporation.*

This unique background of experience in the solution of fly ash recovery problems is available from our office nearest you. May we give you more complete details?

Western Precipitation Corporation

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: **1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA**

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"Do we use Coffing Hoists?

I didn't know there was anything else for the job,"

says G. B. Foscue, Jr., General Manager
Consolidated Telephone Company,
Florence, Kentucky

"The use of the term 'Coffing Hoist' reminds me of the southerner who thought damyankee was one word. I didn't know there was anything else for the job.

"This company has a ¾-ton and a 1½-ton Coffing Hoist in Estill County and two ¾-ton and one 1½-ton Coffing Hoists in Boone County.

"Our foreman tells me that before we had one, four men with a set of blocks did the work now being done by one man using a Coffing Hoist — but it took longer for the four men and the results were not as good.

"The primary uses to which we put Coffing Hoists are pulling proper tension into messenger guys and binding loads of poles. However, you could say they are practically indispensable for moving any heavy object short distances."

Yes, Coffing Hoists, the original ratchet-lever hoists, have played an important role in the development of line construction and maintenance techniques. Their record of safety and durability during more than 25 years of service is one sound reason why companies all over America specify and standardize on Coffing Safety-Pull Ratchet Lever Hoists for all their lifting, stretching and pulling jobs.

For literature and the name of your nearest distributor, write Dept. E5SP.

COFFING HOIST COMPANY
DANVILLE, ILLINOIS

Quik-Lift Electric Hoists • Hoist-Alls • Mighty-Midget Pullers
Spur-Gear Hoists • Differential Chain Hoists • Lead Binders
I-Beam Trolleys

Department of Public Works, a post he had filled since 1948. He joined the department 37 years ago.

M. S. Strickler has been made manager of Westinghouse Electric International Co's new General Products Division. Strickler joined Westinghouse in 1920, serving most recently in New York as manager of industrial sales and lighting apparatus.

Charles C. Hornbostel has been appointed administrative assistant to Pres Earle W. Mills of Foster Wheeler Corp, New York. Previously Hornbostel was president of National Co, Inc, Malden, Mass.

B. B. NEEL

Black Hills P&L Elects B. B. Neel Financial VP

B. B. Neel, secretary-treasurer of Black Hill's Power & Light Co, Rapid City, S. D., has been elected vice president, financial.

In other company appointments, Harold E. Norman, auditor and assistant secretary-treasurer since 1951, was appointed treasurer and assistant secretary. Assistant secretary since 1948, H. R. McIntosh was named secretary and assistant treasurer.

Neel began his electric utility field when he joined General Public Utilities Corp in 1925. After many years with GPU in Arizona, Missouri, and Texas, Neel went in 1934 as auditor to the Dakota Power Co, then one of GPU properties. When Black Hills P&L was formed in 1941, he was made secretary-treasurer, a post he filled until the present promotion.

(*More Personals on page* 255)

TOBE Announces ...TEMPALL POWER CAPACITORS

The power capacitor with QUALITY BUILT IN

Designed
Manufactured
Tested
Guaranteed

Under the same rigid standards for high quality, efficiency, and reliability as applied to all TOBE apparatus furnished for national defense and private enterprise since 1923.

In full compliance with latest NEMA, AIEE, and ASA standards for power capacitors.

A standardized, coordinated design incorporating the latest improvements in materials and processes available for power capacitors.

featuring

Tempall — latest development in the askarel family — the non-inflammable, low-loss impregnant whose characteristics for high dielectric strength and electrical stability are further enhanced for all-temperature operation — from −40C to +46C.

One-piece porcelain terminals with soldered-to-porcelain seals eliminate gaskets and provide positive protection against contamination or loss of dielectric. Liberal creepage distance assures freedom from flashover in any atmosphere.

Best materials available — special, low-density paper dielectric — high line-to-ground case insulation — all-welded steel container — life-time weatherproof zinc-spray finish.

Efficiency and economy. Lowest losses and lowest cost per kilovar. Immediate delivery in reasonable quantities.

SIZES — 15 and 25 KVAR capacity ... RATINGS 2400 to 13800 volts 60 cycles

For complete details, description, and prices, write to

TOBE DEUTSCHMANN
CORPORATION
NORWOOD, MASSACHUSETTS

FINANCIAL AID TO HIGHER EDUCATION

Our Colleges and Universities Face Grave Financial Problems

For the past decade the nation's colleges and universities have been caught in a destructive financial squeeze. It is particularly destructive for the independent, privately endowed institutions. Unless extraordinary measures are taken to relieve this squeeze, it promises to become progressively worse. To let it do that is to court a national disaster.

This is the first of two editorials devoted to the financial plight of our colleges and universities. This first editorial deals with the character of the problem, present and potential. The second will indicate some things that need to be done about it, and particularly what American business might do.

Enrollment Soars, Income Lags

In broad outline, the financial problem that afflicts our colleges and universities is simple. The demand for their services has increased rapidly, and promises to keep on increasing even more rapidly. At the same time, their financial capacity to provide these services has lagged behind, primarily because of price inflation.

Between 1940 and 1950, college and university enrollment increased from approximately 1⅓ million to 2⅓ million—about 75 per cent. Over the same period, the educational income of these institutions, measured in terms of its actual purchasing power, increased only about 64 per cent. Thus, at the end of the decade, our colleges and universities as a group had, on the average, about 6 per cent less to spend per student than they had at the beginning. Meanwhile, the rapid advance of science and technology had made a good college or university course a much more expensive operation than it was in 1940. Since 1950, the latest date for which comprehensive figures are available, the financial squeeze on our colleges and universities has intensified, largely because of another wave of price inflation touched off by the Korean War.

Among the colleges and universities, the independent, privately endowed institutions are particularly hard pressed. In terms of actual purchasing power, the independent liberal arts colleges are now spending at least 20 per cent less per student than they spent in 1940. Public institutions of higher learning, supported out of tax revenues, have managed to increase slightly their expenditure per student. Otherwise, the financial squeeze on higher education as a whole would be even more severe.

Why Independent Colleges Are Hit Hardest

The principal reason why the independent colleges and universities are so hard up is the shrinkage in their income from endowments. These endowments, created in other days by gifts of generous benefactors to help pay the expenses of higher education, have been hit hard from two directions. During the war and post-war years, the tax collector took so large a part of the incomes and estates of wealthy people that this source of endowments has been greatly reduced. Over the same period price inflation cut in half the purchasing power of the income derived from existing endowments. In 1940 income from endowments provided 26 per cent of the total income of the independent colleges and universities. By 1950 it provided only 14 per cent. The figure is still lower today.

The financial plight of the independent colleges and universities is directly reflected in the salary status of their teaching staffs. In mid-1952 a national survey showed that, after adjustment for the increased cost of living, the salaries of those holding full professorial rank in these institutions were 12 per cent lower than they were in 1941-42. Junior teachers, with the rank of instructor, fared somewhat better. In terms of actual purchasing power, their salaries declined only 2 per cent over the 12-year period, largely because there is more direct competition for their services from industry. Over the same period, the real wages of industrial workers increased 55 per cent.

Time Will Not Provide a Cure

The plight of the colleges and universities, which is shared in some degree by all parts of our educational system, is not one that can be left to time for a cure. On the contrary, the financial problems of our institutions of higher learning will be intensified in the years ahead by the pressure of rapidly increasing enrollments. Present prospects indicate that during the next decade college and university enrollment will increase by about one-third, or from 2⅓ million to over 3 million. The problem of increased enrollments will become particularly acute toward the end of this decade when the babies born during the great surge of population in World War II are ready to enter college.

Such an increase in population as that now in prospect can be a tremendous asset to the nation. It is still a truth, even though it is worn a bit thin by frequent repetition at commencement exercises, that a nation has no resource more valuable than the education of its people. And the better the education, the more valuable the asset.

But to realize this, our colleges and universities must have the financial strength to handle the increased enrollments that face them in the years ahead. This means that we must relieve our independent colleges and universities, in particular, from the financial squeeze in which they are now caught and make them full partners in the economic well-being of the nation. Some of the means by which American business might help achieve this will be discussed in a second editorial.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

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MANUFACTURERS & MARKETS

Bids Rejected

Secretary of Army asks companies to submit new tenders for turbine governors for The Dalles project

Secretary of Army Robert Stevens has directed that bids for 16 hydraulic turbine governors for The Dalles Dam on the Columbia River in Oregon be rejected. Ambiguities and failures to comply with specifications were given as the reasons why the contract could not be awarded. No date has been set for readvertising.

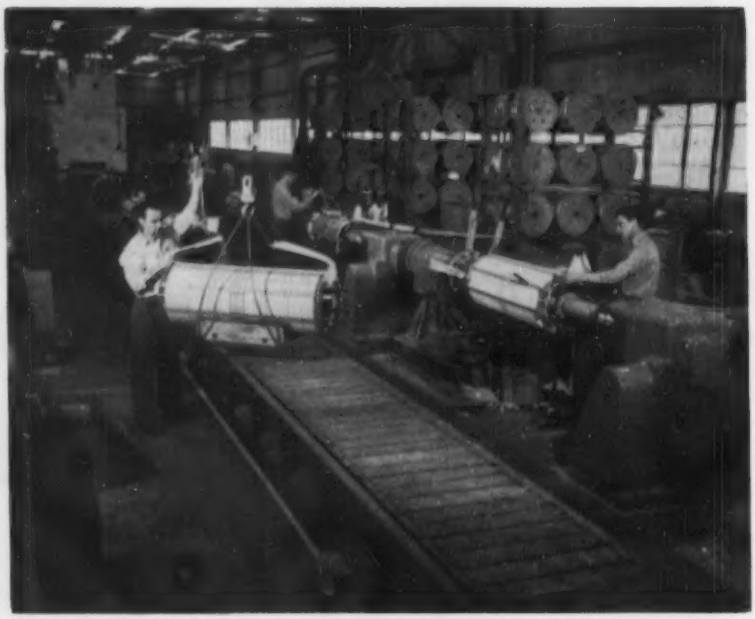
Bids opened Jan. 12 by the district engineer at Portland, Ore., showed this range of prices among the three low proposals for 14 main turbine governors and two auxiliary turbine governors: Hipachi, Ltd, Tokyo, Japan, $1,073,522; Construzion Meccaniche Riva, Milan, Italy, $1,163,628; and Pelton Water Wheel Co, San Francisco, $1,314,785.

Japanese Bid Highest . . . Six bids in all were offered. Surprisingly, the highest bid—topping two more American firms—was also Japanese. Mitsubishi Heavy Industries Reorganized, Ltd, Tokyo, tendered a price of $1,486,202. This is said to be the first time in recent years a foreign firm has been high bidder on Army Corps of Engineers bids for power plant equipment.

Washington observers are speculating that the latest bidding problem may have to be referred to the Defense Secretary or the cabinet for decision, as happened last year on equipment bids for Chief Joseph and McNary Dams.

The Chief of Engineers a week ago had received 20 queries from Congressmen on the pending award for the Dalles. Pelton Water Wheel also sent a three-page letter to the chief and enlisted the active support of Sen Thomas E. Kuchel, California Republican.

Protests Foreign Award . . . Kuchel addressed a letter protesting a foreign award to Defense Secretary C. E. Wilson. "We must have trade with foreign nations," Kuchel declared, "but I do not believe this should include equipment or supplies for any



Conveyor Line in GE's Transformer Plant

General Electric Co's new $25 million medium transformer plant at Rome, Ga., was dedicated earlier this month. Part of the plant's operations is pictured above. A completed coil is shown being moved by crane to conveyor line, which takes the coils to drying oven and test booths seen in the background. A saddle riding on the conveyor protects a coil from damage.

Transformers, rated 501 kva to 10,000 kva, 69,000 v and below, will be produced at the plant, which now consists of ten buildings. Full production is expected by 1955.

EC&M's New Cleveland Plant

Plans to construct a new plant and office buildings on a 27-acre site on Lee Road south of Miles in Cleveland have been announced by Electric Controller & Manufacturing Co, manufacturer of motor control and electric lifting and separating magnets.

The structure (pictured above) includes these main features: Increased engineering and laboratory area and 258,000 sq ft of manufacturing space on one floor.

Completion is scheduled for the spring of 1955. Then EC&M will move all its Cleveland operations to the new location.

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public project within the boundaries of our own nation."

His letter stressed a factor that carries weight with the Corps of Engineers. Kuchel noted general uncertainty over what conditions in the Pacific and in the world may be at the time proposed for delivery. "It would be tragic," he said, "if this equipment were lying on wharves in Japan when its need for the generation of electricity might be vital to the very security of our nation."

Another similar issue will undoubtedly soon be passed to the Army Secretary. Bids opened Feb. 10 for two 14,210-kw generators for the Dalles showed a foreign firm low among eight bidders. American Elin of Austria bid $533,185, while a U. S. firm, the Pacific Oerlikon Co, was second with $699,735.

Where the lowest acceptable bid from a foreign firm involves a difference of less than 25% but amounts to more than $25,000, the Buy American Act—according to the Corps of Engineers—requires the contracting officer to refer the matter to the Secretary of the Army.

By administrative policy decision of the three military and naval departments, the award almost automatically goes to a foreign lower bidder when the lowest American bid exceeds the low foreign bid plus import duty by more than 25%.

In all cases, of course, the technical qualifications of the foreign bidder must be satisfactory. Those qualifications and other applicable conditions are considered in evaluating the bids submitted by foreign companies on power generating equipment slated for installation in federal projects.

BEA Contracts for 132-kv Aluminum Sheathed Cable

British Insulated Callender's Cables, Ltd., recently received from the British Electricity Authority an order for the first 132-kv aluminum-sheathed oil-filled cables to be installed in Great Britain. The cables of single-core construction are part of a contract for the supply and installation of both lead-sheathed and aluminum-sheathed 132-kv oil-filled cables in the 275-kv substation at Elstree, Hertfordshire, in southeastern England.

The contract will permit comparison of 132-kv aluminum-sheathed oil-

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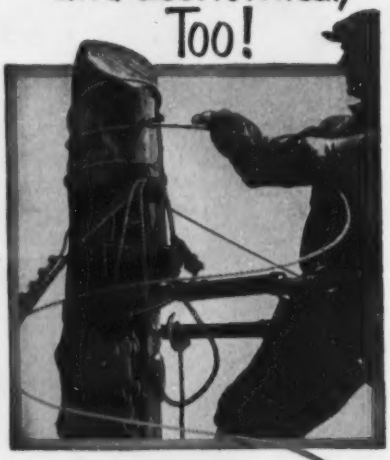

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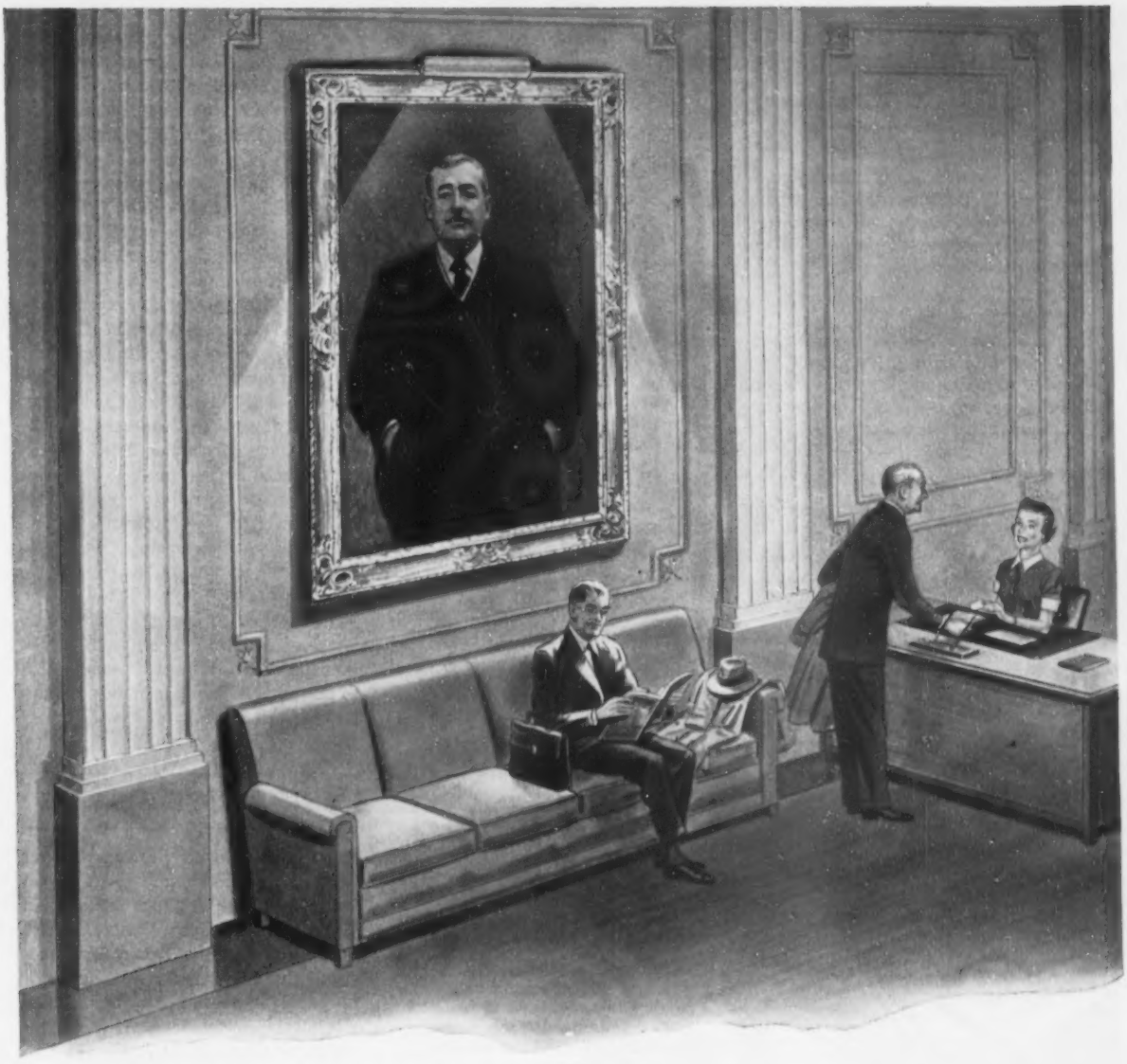

Colonel Byllesby didn't know he was a pioneer . . . . .

It was before the turn of the century that young Henry Byllesby worked side by side with Tom Edison and George Westinghouse. As they each contributed their great knowledge to design the first steam operated electric central station in the world, the farthest thought from Henry Byllesby's mind was that someday he and Tom and George would be regarded as pioneers in electric power. It was therefore more than coincidence that the company he founded in 1902 should later be aptly named, Pioneer Service and Engineering. This is but a tribute to the vision of a man who, with his company, contributed to making America the most powerful nation on earth. This year Pioneer takes pride in celebrating LIGHT'S DIAMOND JUBILEE and pauses a moment to respect the name of its founder . . . *who didn't know he was to be a pioneer.*

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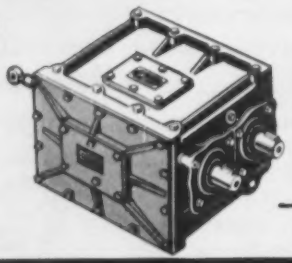

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filled cables with conventional lead-sheathed oil-filled cables rated at the same voltage. The aluminum-sheathed installation will include three straight joints which, although of standard electrical design, will involve the application of plumbing techniques developed in the jointing of lower-voltage aluminum-sheathed cables.

The cable consists of an 8-mm oil duct round which is formed the conductor, consisting of 57/.102-in. plain copper wires, giving the conductor a sectional area of 0.45 sq in. Over the paper insulation are a metallic screen and a copper woven fabric tape. The sheath is 0.11 in. thick and, when swaged down, gives the cable a 2.35-in. diameter. Layers of PVC, rubber and hessian tapes protect the cable which has an overall diameter of 2.81 in. and weighs 16.8 lb per yd. The cable is designed to operate at a maximum stress at the conductor of 85 kv per cm.

Lead-sheathed cable having an identical conductor size has an overall diameter of 2.59 in. and weighs 23.7 lb per yd. The bending radius is similar for both cables.

MANUFACTURING BRIEFS

Plant Expansion . . . Revere Copper & Brass, Inc, has purchased a three-story, 55,000-sq ft office building in Rome, N. Y., from General Cable Corp to expand its Rome Manufacturing Co Division . . . Plans for a $4-million expansion for its facilities in Cleveland, Ohio, have been revealed by Chase Brass & Copper Co, Waterbury, Conn. Work is slated to be completed within one year.

SALES ASSIGNMENTS

Leeds & Northrup Co, Philadelphia, has announced that its Cleveland office has moved to 1922 E. 107th St. from the Euclid Ave. location. D. E. Moat is manager of Cleveland office, and A. F. Moranty, regional manager, is headquartered there.

Line Material Co, Milwaukee, has named Harold E. Rothwell as field engineer in its New York Division to work in northern New Jersey from the company's Union, N. J., office. Richard J. Gawronski was appointed fibre product sales engineer, with headquarters at Des Moines, Iowa, to cover North and South Dakota, Minnesota, Nebraska, Iowa, Missouri, and Kansas. As a result of Gawronski's assignment, Donald H. Hugel now only covers Wisconsin, Illinois, Ohio, Indiana, and Michigan from L-M's Milwaukee office.

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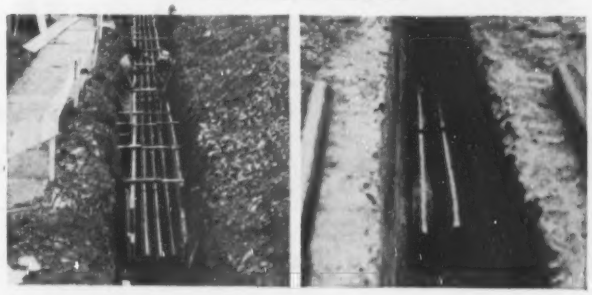

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MEETINGS CALENDAR

CIGRE
International Conference on Large Electric High-Tension Systems, Paris, France, May 12-22.

Pennsylvania Electric Association
Hydraulic Power Committee, The Nittany Lion, State College, Pa., May 17-18; Prime Movers Committee, Castleton Hotel, New Castle, Pa., May 17-18; Communications Committee, Penn-Harris Hotel, Harrisburg, Pa., May 20-21; Electrical Equipment Committee, Lord Baltimore Hotel, Baltimore, Md., May 24-25.

American Institute of Electrical Engineers
Appliance Technical Conference, Subcommittee on Domestic Appliances of Committee on Domestic-Commercial Applications, Morrison Hotel, Chicago, May 17-19; Fourth Welding Conference in cooperation with American Welding Society, Hotel Schroeder, Milwaukee, May 19-21; Conference on Telemetering, Morrison Hotel, Chicago, May 24-26; Summer General and Pacific General Meeting, Hotel Biltmore, Los Angeles, June 21-25; Committee on Petroleum, Conference on Electrical Applications in Petroleum Industry, Mayo Hotel, Tulsa, Okla., Sept. 27-29; Middle Eastern District Meeting, Abraham Lincoln Hotel, Reading, Pa., Oct. 5-7; Fall General Meeting, Morrison Hotel, Chicago, Oct. 11-15.

Pacific Coast Electrical Association
Annual Convention, Hotel Del Coronado, Coronado, California, May 19-21.

Georgia Institute of Technology
Conference on Protective Relay, Atlanta, Ga., May 20-21.

Northwest Electric Light & Power Association
Accounting and Business Practice Section, Davenport Hotel, Spokane, Wash., May 20-21; Personnel Section with EEI Industrial Relations Committee, Multonah Hotel, Portland, Oregon, July 12-14.

1954 National Telemetering Conference
Sponsored jointly by Institute of Radio Engineers, American Institute of Electrical Engineers, Instrument Society of America, and Institute of Aeronautical Sciences, Hotel Morrison, Chicago, May 24-26.

Northwest Public Power Association
Engineering and Operation Section, Benjamin Franklin Hotel, Seattle, Wash., May 20-21.

Edison Electric Institute
22nd Annual Convention, Atlantic City, N. J., June 1-4; Accident Prevention Committee, Mark Hopkins Hotel, San Francisco, July 1-3.

National Association of Electrical Distributors
Annual Convention, Atlantic City, N. J., June 6-11; Pacific Zone Convention, Mark Hopkins Hotel, San Francisco, Oct. 4-7.

American Society of Engineering Education
62nd Annual Meeting, University of Illinois, Urbana, Ill., June 14-18.

Illuminating Engineering Society
Midwestern Regional Meeting, Hotel Jefferson, St. Louis, June 17-19; National Technical Conference, Chalfonte-Haddon Hall, Atlantic City, N. J., Sept. 12-16.

American Society of Mechanical Engineers
Semi-Annual Meeting, William Penn Hotel, Pittsburgh, June 20-24; Fall Meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 8-10.

Nuclear Engineering Conference
Sponsored by American Institute of Chemical Engineers, University of Michigan, Ann Arbor, Mich., June 20-26.

Canadian Electrical Association
Annual Convention, Murray Bay, Quebec., June 24-26.

*Addition this week.

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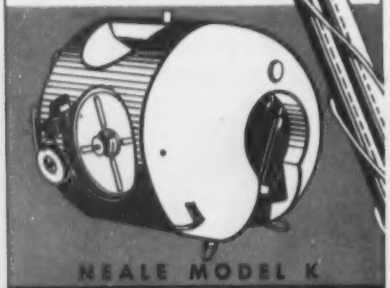

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Automatic Electric of Canada

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TECHNICAL LITERATURE

CONDENSER TUBES — Duplex Tubes Technical Bulletin No. 1954, 16 pages, explains the use of tubes whose inner and outer walls are made of two different metals. Tubes are used for heat exchangers and condensers where outside and inside corrosion conditions are different. Bridgeport Brass Co, Bridgeport 2, Conn.

FIRE BULLETINS—Technical bulletins covering many difficult and unusual fire hazards are available from Ansul Chemical Co, Marinette, Wis.

1. Effect of packed dry chemical on operation of Ansul dry chemical fire extinguishers.
8. Fires in molten-salt hardening baths.
9. Effect of Ansul dry chemical on electric motors and generators.
18. Fire hazard—lithum aluminum hydride.
21. Fire hazard—storage of sodium nitrate.
22. Fire hazard—sulfur.
25. Transformer oil fires in crushed stone—2 pages.
26. Recommended fire protection of liquified petroleum gas storage, unloading, and processing areas.
27. Fire hazard—aircraft flares.
28. Nitrogen as an expelling agent for dry-chemical fire extinguishers—2 pages.
29. Temperature correction chart for checking pressures of 110 and 220 cu ft nitrogen cylinders—2 pages.
30. Temperature correction chart for checking pressures of 400 cu ft nitrogen cylinders—2 pages.
31. Carbon-dioxide cartridges—2 pages.
32. Natural gas fire tests—8 pages.
33. Effect of dry-chemical extinguishing materials on the viability of seeds.

TRANSFORMER MOVIE—"The Story of the Round-Wound Transformer," 16-mm sound and color, explains manufacture and testing of distribution transformers through 500 kva. Running time, 22 minutes. Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.

PROTECTIVE COATINGS—Booklet, 50 pages, contains 7 reprints covering chemical-resistant coatings. Atlas Mineral Products Co, Mertztown, Pa.

STAINLESS STEEL—"Allegheny Metal in Chemical Processing," 34 pages, covers uses of stainless steel. Allegheny Ludlum Steel Corp, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

SCREEN ROOMS—"Evaluating Shielded Enclosures," 16 pages, discusses screen rooms. Ace Engineering and Machine Co, 3644 N. Lawrence St, Philadelphia 40, Pa.

SEMICONDUCTORS—Following booklets, giving specifications, are available from Raytheon Manufacturing Co, 55 Chapel St, Newton 58, Mass.:

PNP Junction Germanium Transistors 20 pages

Hermetically Sealed Germanium Diodes 16 pages

CABLES—"Cable Operation—1951," 18-page report, covers experience on paper-insulated cable, joints, and terminations operating above 7.5 kv between phases. Price, $1.75. Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

BERYLLIUM COPPER—Bulletin 1, 8 pages, gives ordering information and data on beryllium-copper precision strip. Penn Precision Products, Inc, 501 Crescent Ave, Reading, Pa.

WATTMETERS—Engineering Notes, Vol. 9, No. 1 covers Model 905 ac and dc portable watt-meters. Weston Electrical Instrument Corp, 614 Frelinghuysen Ave, Newark 5, N. J.

MURCO SPILLWAY GATE HOISTS

8 MURCO Spillway Gate Hoists, 125 ton capacity, installed by the Washington Water Power Co., Cabinet Gorge Project, Clark Fork River, Idaho.

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Murco Gate Hoists are designed and built in a wide range of capacities from less than one ton to over one hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist. In over 50 years of designing and building gate hoists, we have developed designs for many gate hoist problems. We may have designs and patterns to fit your special requirements. In planning gates or gate hoists, we suggest you write us before your over-all plans are complete . . . it may save time and money. We also build gate hoists to fit your plans and specifications.

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HAZARDOUS CODE—Bulletin 2655 gives Art. 500 and 510 of 1953 NEC and appropriate equipment and methods of application. Crouse-Hinds Co, Cor. Wolf & Seventh North St, Syracuse 1, N. Y.

REGULATED SUPPLIES—Catalog 254, 32 pages, covers principles of ac and dc regulated sources. Sorensen & Co, Inc, 375 Fairfield Ave, Stamford, Conn.

AUTOMATIC TRANSFER — Publication 502, 4 pages, gives data for selecting automatic transfer switches. Automatic Switch Co, 391 Lakeside Ave, Orange, N. J.

ELECTROPLATING—"Specifications and Tests for Electrodeposited Metallic Coatings," 96 pages, is a compilation of relevant specifications, methods, and practices. Price, $1.85. American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa.

THERMISTORS — Manual TH-13, 54 pages, covers specifications and applications for Carboloy thermistors. General Electric Co, Box 237, Roosevelt Park P. O., Detroit 32, Mich.

ASA STANDARDS—The following are available from American Standards Association, 70 E. 42nd St, New York 17, N. Y.:

Publication 68 Basic Climatic and Mechanical Robustness Testing Procedure for Components. French and English, 52 pages. Published by International Electrotechnical Commission. Price, $2.00

C57.12a-1954 American Standard Requirements for Transformers, 67,000 Volts and Below, 501 through 10,000 Kva, 3 Phase, 501 through 5,000 Kva, 1 Phase—28 pages. Price, $1.00

Loan Approvals for Co-ops Being Stepped Up by REA

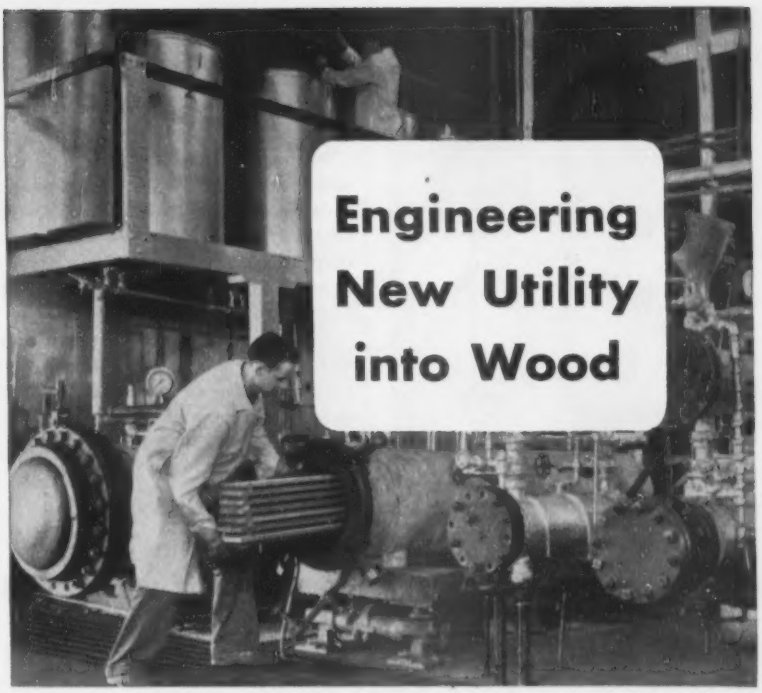
Rural Electrification Administration is stepping up loan approvals for rural electric cooperatives during the current fiscal year.

Recently released hearings of the House Appropriations Committee show that REA approved electric loans during the January-March quarter of this year totaling $60.8 million as compared with $32.9 million for the same quarter last year. The total for the 1954 quarter is the highest for any quarter since June 1952.

Loans for March 1954 totaled $29,540,500, including $12,135,850 for generation and transmission and $150,000 for consumer facilities.

For the first three quarters of the present fiscal year, the agency has approved electric loans amounting to $119.4 million compared with $108.6 million for the same period during the previous fiscal year.

REA Administrator Ancher Nelsen now estimates that total loans during the present fiscal year may range from $150 to $165 million. This means he will have to dip into the contingency loan authorization funds provided by Congress, since the agency previously planned a program of $135 million.



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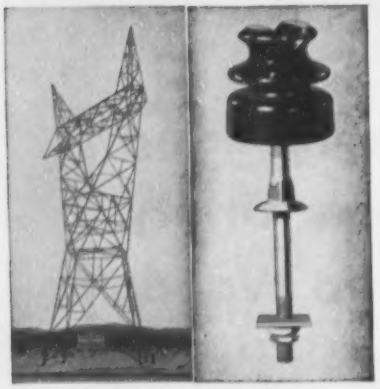

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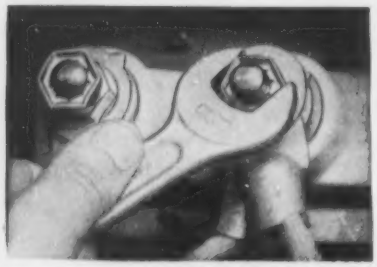

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(*Continued from page* 132)

the company's best interest, he declared.

Nichols said the Texas drought did not affect the company as drastically as expected, but it did prompt the company to reduce the increase in output budgeted for the fiscal year—from a 15½% kwh increase to a 8-9% boost.

Nichols outlined the company's financial program at a meeting in San Francisco designed to acquaint brokers and the press with the company's operations and its stock.

PGE, PP&L May Launch Campaign to Finance Hotel

Portland General Electric and Pacific Power & Light companies may jointly lead off a campaign in Portland, Ore., to raise $1 million of local equity toward financing of a proposed $13.5 million 20-story hotel.

PGE Vice Pres Waldemar Seaton Jr and PGE Director Ralph Thom reported recently they had been named on a special committee to confer with PP&L officials on feasibility of investing capital funds of the private utilities in the hotel venture. The two companies would share in the hotel's electric power contract. It was understood the companies had been asked to invest $200,000 taking 11-year debentures which would draw 6%.

Pacific P&L Holders Approve MSP Merger

Pacific Power & Light Co stockholders have made formal their approval of merger of the company and the Mountain States Power Co expected to be consummated in May or early June. Holders of 91.43% of shares outstanding were represented at the session in Augusta, Me., and 99.44% of the shares were voted for the merger previously approved by PP&L directors and already voted by MSP stockholders.

The approval was a formality, since canvass of proxies at the March 12 original convening of stockholders had indicated virtually unanimously in favor of the proposal. Final action had

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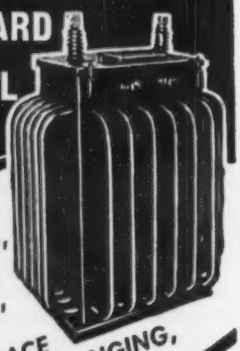

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been deferred to allow some state regulatory commissions to act and to conform with Maine laws governing filing dates for final papers.

Testifying before the Idaho Public Utilities Commission late last month, PP&L's Pres Paul B. McKee said that the enlarged PP&L would "very likely" build electric generation projects in Idaho. He said there were no definite plans, but added that preliminary studies indicate the merger would make possible rate reductions in some northern Idaho districts now supplied by MSP.

Oregon and Washington commissions have already given approval to the merger. As EW went to press, the company was expecting to receive approvals from the Idaho and Wyoming commissions.

Protests Proposed Sale of Pend Oreille Co-op

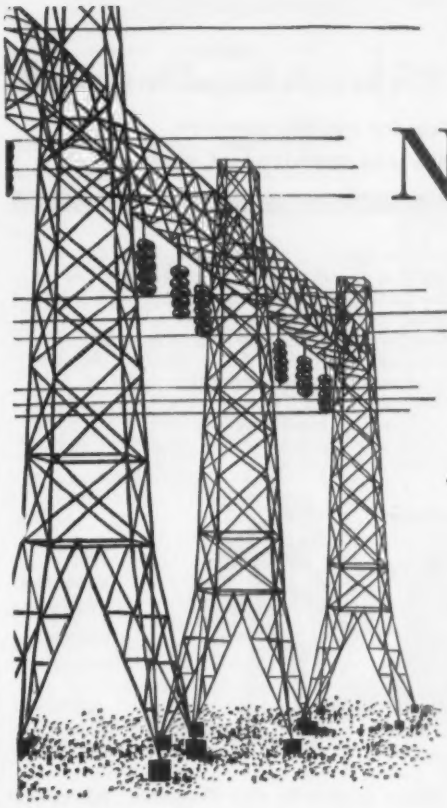
Washington Water Power Co has protested the proposed sale of a small northeastern Washington power cooperative that WWP was excluded from buying. Kinsey M. Robinson, WWP president, protested the freeze out in a letter to the 1,000 members of the utility, the Pend Oreille Electric Cooperative, Inc.

The cooperative, after deciding to sell, drew a sale proposal and forwarded it to the Rural Electrification Administration offering to sell its facilities to Pend Oreille County Public Utility District and to Inland Power & Light Co, Spokane, another REA cooperative.

Although WWP met last December with directors of the Pend Oreille Electric Co-op, declared Robinson, when the time to sell came WWP was not given a chance to buy. The co-op serves Bonner County, Idaho, and parts of Spokane and Pend Oreille counties, Washington.

"The only place where we found any expression of interest in WWP among our members," said Co-op Pres L. C. Peterson "was in Bonner County. The water power company said it was not interested in buying this section alone."

The Pend Oreille County PUD indicated it would sue to condemn any properties within its boundaries sold to WWP, so directors of the co-op excluded WWP from their consideration of purchasers.



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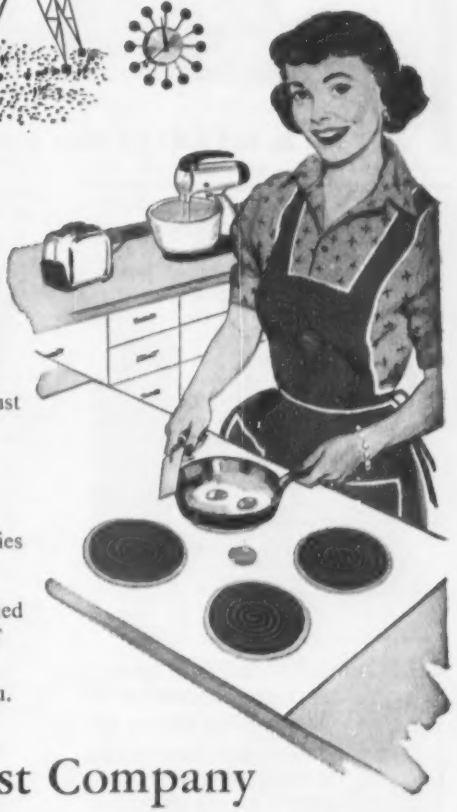

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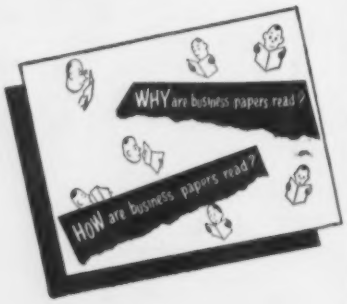

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BOOKS

Received Since April 27

Electronics—An Electrical Engineering Approach. By G. F. Corcoran and H. W. Price. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 459 pages. Price $7

Hail Columbia—The 30-Year Struggle for Grand Coulee Dam. By George Sundborg. Published by The Macmillan Co, 60 Fifth Ave, New York 11, N. Y. 467 pages. Price $5.75

Elektrische Maschinen—Vol. III. By Rudolf Richter. Published by Verlag Birkhauser Basel/Stuttgart, Switzerland. 321 pages, illustrated. Price DM 26

Metals and How to Weld Them. By T. B. Jefferson and Gorham Woods. Published by The James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio. 322 pages, illustrated. Price $2.00 in USA, $2.50 elsewhere

Streamlined Drafting

Simplified Drafting Practice. By William L. Healy and Arthur H. Rau. Published by John Wiley & Sons, Inc, New York 16, N. Y. 156 pages, illustrated. Price $5.00

This book marks the first major change in industrial drafting practices in years. Methods are advanced that can strip drafting of its frills, yet sacrifice nothing in either clarity or accuracy. Savings of 30 to 50% are produced by elimination of nonessentials, extensive use of free-hand drawing, and simplification of delineation.

"Before and after" illustrations are accompanied by explanations of mechanical aids, symbols, abbreviations, and free-hand drawing. Other devices are arrowless dimensioning, legible lettering, tolerances, reproduction processes, and basic design of the drawing form. This book is recommended for draftsmen in all phases of engineering, and for the engineers who supervise their work.

How to Design Electrical Machines

Elements of Electrical Machine Design: 3rd edition. By Alfred Still and Charles S. Siskind. Published by McGraw-Hill Book Co, Inc, New York 36, N. Y. 437 pages, illustrated. Price $9.00.

Purpose of this book is to aid in understanding fundamental principles through their application to concrete designs of electrical machines. This contrasts with methods followed by experienced designers who have adapted design sheets, compiled constants and use "short cuts." The design method presented is thought to be helpful in developing new types of machines without consideration of existing patterns and tools.

Design principles of four basic machines are covered—dc generators, ac generators, three-phase induction motors, and transformers. Included are illustrative examples, test problems and a chapter on mechanical de-

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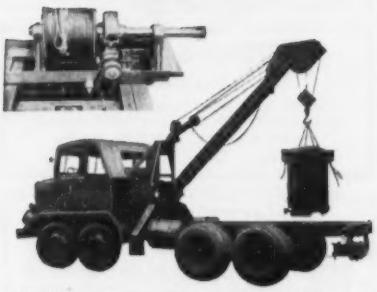

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sign. This volume should be valuable to students of electrical engineering and a helpful reference to utility engineers interested in design.

Aids Study of AC Machines

The Performance and Design of Alternating Current Machines. **By M. G. Say. Published by Sir Isaac Pitman & Sons, Ltd, London, England. 636 pages, illustrated. Price $6.75.**

This book is a revision of the Second Edition, 1948. Scope is limited to the three principal types of ac machines—the transformer, the three-phase induction motor, and the synchronous motor and generator. For each type an outline of the simple theory is presented, followed by details of performance, control, testing, construction and design. Descriptions are restricted because modern practice is obtainable from current periodicals.

Prior to the contents, a reading guide is included, suitable for those persons, with basic knowledge of electro-technology who are studying ac machinery for the first time. This book is appropriate for students and utility engineers interested in heavy electrical equipment but who do not specialize in machine design.

All About Synchronous Motors

The Synchronous Induction Motor. **By J. Griffin. Published by Macdonald & Co, Ltd, London, England. 136 pages, illustrated. Price 18 s net.**

Here the author treats the synchronous induction motor as a specific type of machine. The volume is devoted entirely to this type of motor and is a comprehensive review of the subject. Chapters cover starting, synchronizing, elementary synchronous motor theory, power factor correction, overload capacity, automatically variable excitation, dynamic braking, inversion, secondary windings, salient poles, exciting current calculations and general construction.

Junior, design and operating engineers, also teachers, should find this book a convenient reference. The bibliography lists 33 items, one being by E. Danielson, a Swedish engineer reportedly the inventor of the synchronous motor, "Der Asynchromotor als Synchronmotor", *Elektrotechnische Zeitschrift*, 1901, Vol. 22, p. 10651.

Price Is $1 Each

Numerical Tables and A Manual on Catenary Calculations, **By J. W. Campbell, 11138-87 Ave, Edmonton, Can.**

These two books were reviewed in the April 19 issue, p 220. Purchasers have overlooked the correct price listed in the review. $1 each and not $1 a set.

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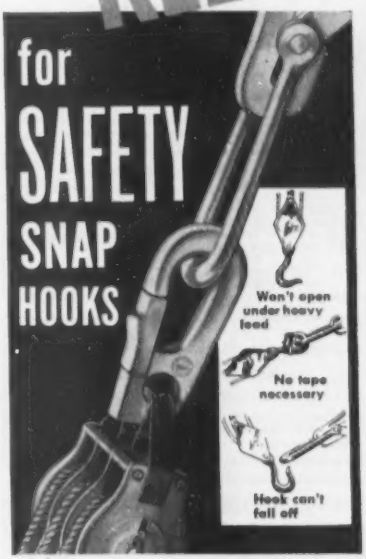

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Detroit Edison Fills Key Posts

President Cisler will assume board duties in July when Prentiss Brown retires as chairman. Landrigan elevated

WALKER L. CISLER

Detroit Edison Co has announced that with the consolidation of the duties and responsibilities of the president and board chairman, Pres Walker L. Cisler will become principal executive officer of the company effective July 1. At that time, Prentiss M. Brown, chairman of the board, and Arthur S. Albright, executive vice president, will retire.

Vice Pres Charles R. Landrigan will take over in July the office of executive vice president to succeed Albright.

Chairman of A- Unit . . . Cisler joined the company in 1943 as chief engineer of power plants. He was elected executive vice president in 1948, a director in 1951, and president in December of that year. He is chairman of the management committee of the Dow Chemical-Detroit Edison and Associates Atomic Power Development Project.

With Detroit Edison since 1912, Landrigan became assistant comptroller in 1932, comptroller in 1949. He was made a vice president in 1953.

Brown, a former U. S. Senator, came to Detroit Edison as chairman of the board in 1944. Brown, who is a lawyer, will continue after his retirement as a member of Edison's board.

Albright became affiliated with the Detroit utility in 1912, later becoming comptroller and treasurer. After serving as a vice president, he was made executive vice president of the utility in 1953.

CHARLES R. LANDRIGAN

OBITUARY

Carl E. Becraft, 69, former superintendent for Montana-Dakota Utilities Co at Miles City, Mont., and an electrician at Prineville, Ore., until his recent retirement, died at Prineville, last month.

Ralph N. Malehorn, 59, comptroller of New Jersey Power & Light Co from 1944 until his retirement last February due to illness, died April 29. Malehorn, who started his utility career in 1913, joined Metropolitan Edison Co at Reading, Pa., ten years later. He became associated with New Jersey Power & Light in 1935.

Paul J. Farran, 57, system director of personnel for Pennsylvania Electric Co since 1944, died April 23 at Johnstown, Pa. In his 25-year utility career, Farran was employed by Penelec and affiliated companies in Johnstown, Pa., and Ithaca, N. Y. He also served as personnel director for the company's Southern and Central Divisions for six years.

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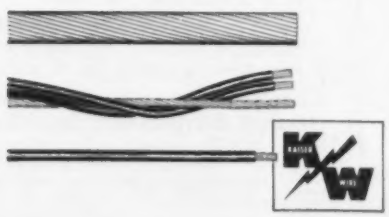

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200	Westgh.	4160	250
200	G. E.	440	550
200	Ridgway	2300	250
170	G. E.	440	125
150	G. E.	440	125/250
150	G. E.	4000	250
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150	G. E.	440	275
100	Westgh.	440	125
100	Elec. Mch.	440	125
100	Ridgway	2300	275
100	G. E.	240	230
100	G. E.	440	125
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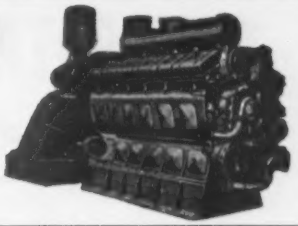

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1100	General Motors	16-278A	1600	720	320	Enterprise	DSG-6	560	450
750	General Motors	12-567	1080	720	300	General Motors	8-268A	450	1200
700	Worthington	EE-8	1000	327	200	General Motors	8-268A	350	900
500	General Motors	8-278A	750	720	150	Worthington	CC-4	225	450
500	General Motors	8-567	720	720	150	Ingersoll-Rand	8-4	225	600
500	Alco	6-12 1/x13T	750	600	150	Buckeye	80	240	600
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4	500	West.	69000—6900
3	400	G. E.	66000/33000—2300/4160
3	333	Stand.	69000/34500—7200/12470 Y
3	200	Pitts.	66000—2300
3	1250	A. C.	44000/11500—460
4	150	West.	44000/33000—2300/6900
3	75	West.	44000—7200/12470 Y
3	5000	G. E.	38100/66000—6600
4	4500	G. E.	36000—13300—2400
2	15000	West.	33000—2400/4160 Y, 3 ph.
3	3333	G. E.	33000/11000—2400/7200
3	333	G. E.	33000—7200/12470 Y
3	250	Mol.	33000—13800—23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
3	1250	G. E.	26400/13200—2400
1	1000	A. C.	26400—4160, 3 ph. LOAD R/C
4	1500	A. C.	25400/4400 Y—6900/13800
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3	250	G. E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
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2—2000 A. 15 KV G. E. FHKO-239-1500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
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2—	2000	G.E.	514	600	6600/13200
1—	2000	G.E.	500	666 25 cy.	11000
2—	2000	G.E.	450	600	2300/4600
1—	1500	C.W.	514	115	4000/13800
1—	1500	G.E.	720	600	13200
1—	1000	G.E.	900	260	4100/6900
2—	1000	Whse.	900	600	2300/4150
3—	1000	G.E.	720	600	2300/4600
1—	750	Whse.	900	275	2300/4150
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300

TURBO GENERATORS

Qu.	KW	Make	Desc.
1—	4000	G.E.	Condensing—425 lbs—750° F.T.T.—Surface Condenser 3/60/2300-4000 v with exciter
1—	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1—	1000	Moore	Condensing — Extraction — 190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter.
1—	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B. P., 480-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1—	12000	Whse.	60/25	13200 x 13200
1—	3750	G.E.	60/25	4150/2400 x 2400/4150
1—	3125	G.E.	25/60	4150/2400 x 2400/4150
2—	2500	G.E.	25/62½	2300 x 4160
1—	1250	G.E.	25/58.3	4400 x 2300
1—	625	A.C.	25/60	11000 x 2300

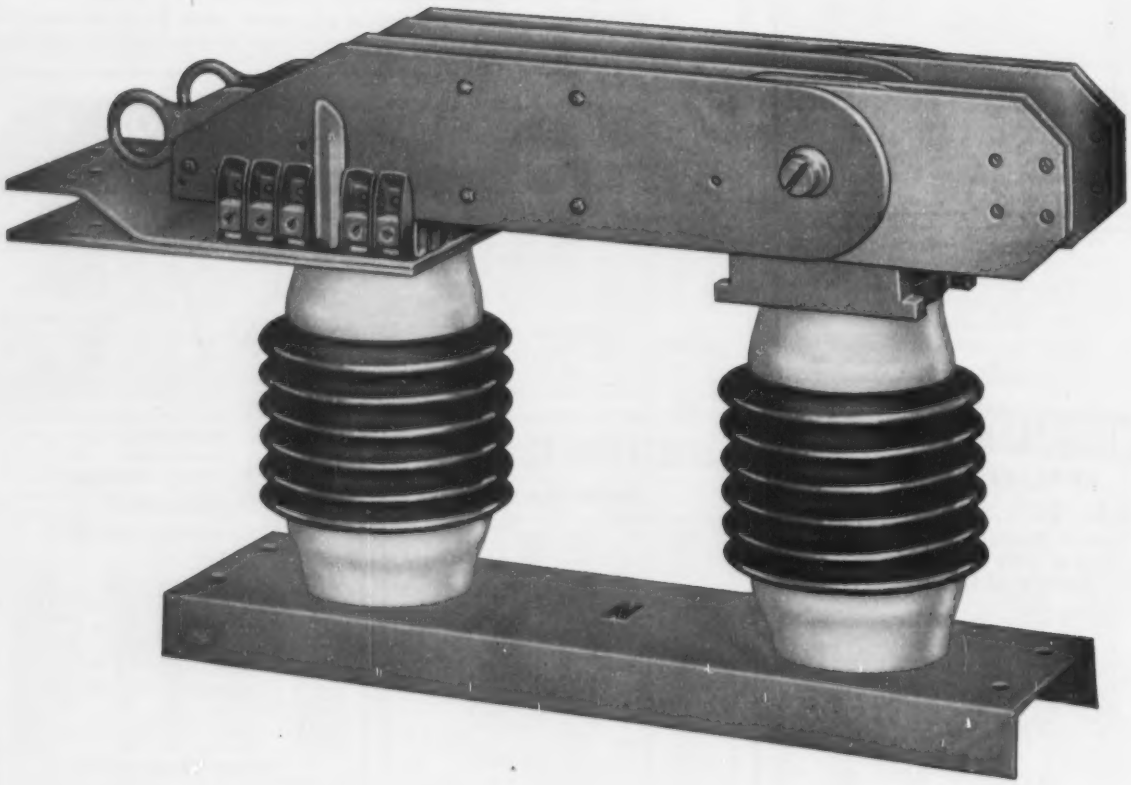
TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—2500	Whse.	OISC	3	26400/13200 x 480
3—2000	G.E.	HVDDJ	1	66000 x 13800
1—1500	G.E.	HT	3	13200 x 2300
3—1250	G.E.	HVDDJ		6600/550
3—1000	G.E.	HVDDJ	1	2200/480

BELYEA COMPANY, INC.
51 Howell Street, Jersey City 6, N. J.

Cole Electric Co.

8439 Steller Drive TExas 0-4701 Culver City, Calif.



OUTDOOR HOOK STICK DISCONNECTING SWITCH
23,000 Volts—4,000 Amperes—Type Y-2
Single Pole, Single Throw
See Bulletin 20-A
SILVER TO SILVER CONTACTS

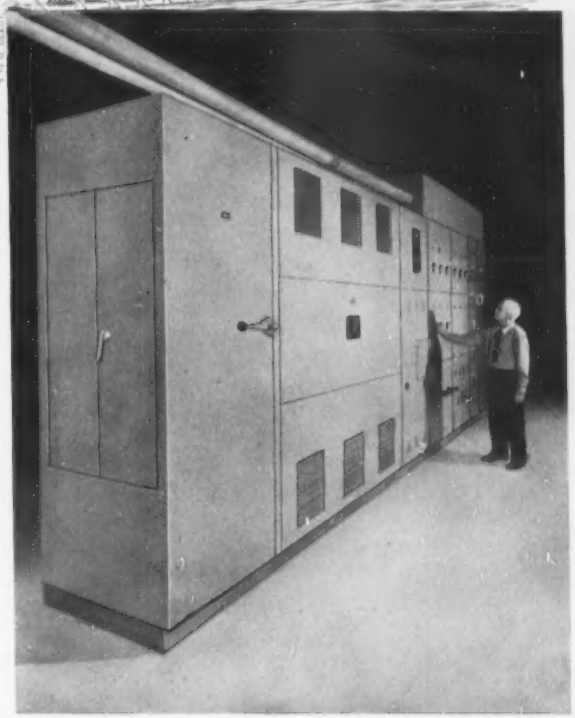
FEDERAL NOARK® POWER CENTER... THE WINNER AT LAUREL!

IT TAKES ELECTRICITY to operate a race track. Without electricity you'd have trouble buying an admission ticket or placing a bet . . . and how could the horses get through the gates or give you a photofinish? Well, Laurel, in Maryland, is today's most modern track, and its electrical system is controlled by Federal Noark main service equipment, lighting and power panels, motor controls, control centers and a unit substation.

Federal Noark equipment is today's best answer in buildings of every type and wherever else there's an electric light and power control problem. Most of this equipment is factory-assembled from standard units to meet individual specifications. All of it brings minimum installation costs . . . and is designed for maximum efficiency, easiest maintenance and remarkable flexibility for later changes or expansion.

Next time you have an electrical distribution problem, pass it on to Federal Noark for the most practical and economical solution.

FEDERAL ELECTRIC PRODUCTS COMPANY
50 PARIS STREET, NEWARK 5, N. J.



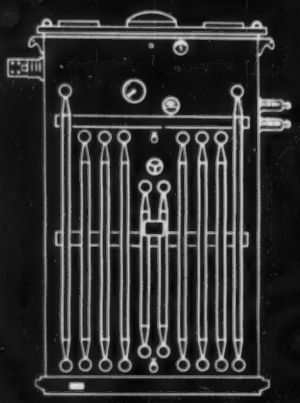
Federal Noark Power Center at Laurel Race Course. Factory-assembled and tested. Circuit breakers completely interlocked in all positions . . . high voltage switches coordinated with power fuses. Complete sectionalizing between high and low voltage and individual breakers makes maintenance safe and easy. On the complete Laurel electrical system, Architect was Arthur Froehlich, Beverly Hills, California; Contractor, Harry S. Mickey, Baltimore, Maryland.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — **Pacific Electric Manufacturing Corporation products:** High voltage circuit breakers and power switches ★ Sales offices in principal cities.

FEDERAL NOARK®

KUHLMAN

KUHLMAN SAF-T-KUHL TRANSFORMERS PROVIDE SAFE POWER DISTRIBUTION WITH ECONOMICAL INSTALLATION A PRODUCT OF RECOGNIZED DEPENDABILITY . . . THE RESULT OF OVER 60 YEARS OF PROGRESSIVE ENGINEERING



BAY CITY, MICHIGAN — CRYSTAL SPRINGS, MISSISSIPPI — EXPORT REPRESENTATIVES: INTERNATIONAL STANDARD ELECTRIC CORP., 15TH FLOOR, 50 CHURCH STREET, NEW YORK 7, N.Y. — CABLE ADDRESS: MICROPHONE, N.Y.